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CONTENTS OF VOLUME 65

EDITORIALS

	Page.
Opportunities for engineering research in agriculture, by R. W. Trullinger	1
The passing of Jordan, Comstock, and Pammel	101
The Pennsylvania Soil Fertility Conference	301
Other summer meetings of 1931	306
The Guelph meeting of the Canadian Society of Technical Agriculturists	306
The quarter centennial of the American Society of Agricultural Engineers	401
A brief history of the South Carolina Experiment Station	405
Babcock and Spillman, deceased	601
James T. Jardine, fifth chief of the Office of Experiment Stations	701
The agricultural experiment stations in 1930	702

STATION PUBLICATIONS ABSTRACTED

Alabama Station:

Circular 58	331
Circular 59	479
Forty-first Annual Report, 1930	415,

428, 434, 437, 449, 455, 459, 460, 464, 471, 475, 480, 492, 493, 494, 496

	Page
ALASKA STATIONS:	
Bulletin 9	732
ARIZONA STATION:	
Bulletin 137	60
Technical Bulletin 32	596
ARKANSAS STATION:	
Bulletin 247	761
Bulletin 260	280
Bulletin 261	575
Bulletin 262	678
Bulletin 263	633
Bulletin 264	732
Bulletin 265	721
CALIFORNIA STATION:	
Bulletin 504	81
Bulletin 505	52
Bulletin 506	351
Bulletin 507	148
Bulletin 508	110
Bulletin 509	156
Bulletin 510	189
Bulletin 511	345
Bulletin 512	280
Bulletin 513	483
Circular 321	150
Hilgardia—	
Volume 5—	
No. 8	150
No. 9	147
No. 10	128
No. 11	137
No. 12	361
No. 13	232
No. 14	262
No. 15	318
No. 16	447
No. 17	256
No. 18	533
Volume 6—	
No. 1	658
Annual report, 1930	708, 718, 722, 723, 727, 734, 742, 743, 752, 755, 761, 762, 763, 765, 768, 769, 777, 778, 788, 795, 796
COLORADO STATION:	
Bulletin 362	717
Bulletin 363	717
Bulletin 364	717
Bulletin 365	90
Bulletin 366	91
Bulletin 367	139
Bulletin 368	82
Bulletin 369	84

COLORADO STATION—Continued. Page
Bulletin 370 35
Bulletin 371 33
Bulletin 372 72
Bulletin 373 650
Forty-third Annual Report, 1930 399

CONNECTICUT STATE STATION:
Bulletin 323 9
Bulletin 324 36
Bulletin 325 255
Bulletin 326 334, 356
Bulletin 327 451
Bulletin 328 549
Bulletin 329 789

CONNECTICUT STORRS STATION:
Bulletin 171 (Report 1930) 726, 769, 775, 776, 777, 781, 797

DELAWARE STATION:
Bulletin 167 436
Bulletin 168 407
Bulletin 169 782
Bulletin 170 763
Bulletin 171 783

FLORIDA STATION:
Bulletin 222 149
Bulletin 223 232
Bulletin 224 886
Bulletin 225 843
Annual Report 414, 415, 429, 434, 438, 451, 454, 455, 459, 467, 472, 475, 480, 488, 496

GEORGIA STATION:
Bulletin 166 139
Circular 92 899
Forty-third Annual Report, 1930 123, 141, 142, 158, 161, 184, 191, 192, 197

HAWAII STATION:
Bulletin 62 715
Circular 1 368
Report, 1930 712, 716, 730, 737, 788, 793, 797

HAWAIIAN PINEAPPLE CANNERS' STATION:
Pineapple Quarterly—
Volume 1—
No. 1, April, 1931 620, 622, 626, 640, 641, 650
No. 2, June, 1931 813, 815, 835, 844, 852, 853

IDAHO STATION:
Bulletin 175 281
Bulletin 176 255
Bulletin 177 226
Bulletin 178 222
Research Bulletin 8 228

	Page
Alaska Stations:	
Bulletin 9	732
Arizona Station:	
Bulletin 137	60
Technical Bulletin 32	596
Arkansas Station:	
Bulletin 247	761
Bulletin 260	280
Bulletin 261	575
Bulletin 262	678
Bulletin 263	633
Bulletin 264	732
Bulletin 265	721
California Station:	
Bulletin 504	81
Bulletin 505	52
Bulletin 506	351
Bulletin 507	148
Bulletin 508	110
Bulletin 509	156
Bulletin 510	189
Bulletin 511	345
Bulletin 512	280
Bulletin 513	483
Circular 321	150
Hilgardia—	
Volume 5—	
No. 8	150
No. 9	147
No. 10	128
No. 11	137
No. 12	361
No. 13	232
No. 14	262
No. 15	318
No. 16	447
No. 17	256
No. 18	533
Volume 6—	
No. 1	658
Annual report, 1930	708, 718, 722, 723, 727, 734, 742, 743, 752, 755, 761, 762, 763, 765, 768, 769, 777, 778, 788, 795, 796
Colorado Station:	
Bulletin 362	717
Bulletin 363	717
Bulletin 364	717
Bulletin 365	90
Bulletin 366	91
Bulletin 367	189
Bulletin 368	82
Bulletin 369	84

COLORADO STATION—Continued. Page
Bulletin 370 — 35
Bulletin 371 — 33
Bulletin 372 — 72
Bulletin 373 — 650
Forty-third Annual Report, 1930 — 399

CONNECTICUT STATE STATION:
Bulletin 323 — 9
Bulletin 324 — 36
Bulletin 325 — 255
Bulletin 326 — 334, 356
Bulletin 327 — 451
Bulletin 328 — 549
Bulletin 329 — 789

CONNECTICUT STORRS STATION:
Bulletin 171 (Report 1930) — 726, 769, 775, 776, 777, 781, 797

DELAWARE STATION:
Bulletin 167 — 436
Bulletin 168 — 407
Bulletin 169 — 782
Bulletin 170 — 768
Bulletin 171 — 783

FLORIDA STATION:
Bulletin 222 — 149
Bulletin 223 — 232
Bulletin 224 — 886
Bulletin 225 — 843
Annual Report — 414, 415, 429, 434, 438, 451, 454, 455, 459, 467, 472, 475, 480, 488, 496

GEORGIA STATION:
Bulletin 166 — 139
Circular 92 — 899
Forty-third Annual Report, 1930 — 123, 141, 142, 158, 161, 184, 191, 192, 197

HAWAII STATION:
Bulletin 62 — 715
Circular 1 — 368
Report, 1930 — 712, 716, 730, 737, 788, 793, 797

HAWAIIAN PINEAPPLE CANNERS' STATION:
Pineapple Quarterly—
Volume 1—
No. 1, April, 1931 — 620, 622, 626, 640, 641, 650
No. 2, June, 1931 — 813, 815, 835, 844, 852, 853

IDAHO STATION:
Bulletin 175 — 281
Bulletin 176 — 255
Bulletin 177 — 226
Bulletin 178 — 222
Research Bulletin 8 — 228

ILLINOIS STATION: Page
Bulletin 366 367
Bulletin 367 368
Bulletin 368 373
Bulletin 369 589
Bulletin 370 323
Bulletin 371 732
Circular 368 479
Circular 369 255
Circular 370 892
Circular 371 479
Circular 372 561
Circular 373 586
Circular 374 765
Soil Report 47 117
Soil Report 48 117
Soil Report 49 811

INDIANA STATION:
Bulletin 340 64
Bulletin 343 61
Bulletin 344 61
Circular 175 70
Circular 176 67
Circular 177 38
Circular 178 56
Circular 179 52
Circular 180 249
Circular 181 659
Forty-third Annual Report, 1930 108, 112, 124, 133, 141, 143, 152, 158, 159, 162, 167, 169, 171, 174, 182, 184, 191, 196, 198

IOWA STATION:
Bulletin 253 (abridged) 159
Bulletin 274 77
Bulletin 275 87
Bulletin 276 21
Bulletin 277 63
Bulletin 278 661
Bulletin 279 635
Bulletin 280 620
Research Bulletin 134 67
Research Bulletin 135 20
Research Bulletin 136 65
Research Bulletin 137 667
Research Bulletin 138 629
Research Bulletin 139 619
Circular 125 149
Circular 126 667
Circular 127 677
Circular 128 684
Circular 129 682
Soil Survey Reports 60–65 17
Annual Report, 1930 110, 113, 119, 124, 135, 144, 153, 159, 163, 166, 167, 169, 172, 179, 183, 185, 193, 196, 198

KENTUCKY STATION: Page
Bulletin 311 — 185
Bulletin 312 — 278
Forty-first Annual Report, Part 2 — 99

LOUISIANA STATIONS:
Bulletin 220 — 488
Bulletin 221 — 484
[Bulletin 222] — 718
Bulletin 223 — 828
Circular 5 — 66

MAINE STATION:
Bulletin 355 — 189
Bulletin 356 — 756
Bulletin 357 — 748, 749, 797
Official Inspections 138 — 133, 137

MARYLAND STATION:
Bulletin 323 — 129
Bulletin 324 — 868
Bulletin 325 — 861
Forty-third Annual Report, 1930 — 99

MASSACHUSETTS STATION:
Bulletin 270 — 714
Bulletin 271 (Annual Report, 1930) — 315, 317, 330, 337, 338, 343, 353, 356, 358, 368, 370, 371, 375, 394, 399
Bulletin 272 — 436
Bulletin 273 — 474
Bulletin 274 — 637
Control Series Buletin 54 — 22
Control Series Bulletin 55 — 60
Control Series Bulletin 56 — 38
Control Series Bulletin 57 — 23
Control Series Bulletin 58 — 776
Meteorological Series Bulletins 507–510, March–June, 1931 — 510

MICHIGAN STATION:
Special Bulletin 207 — 88
Special Bulletin 208 — 88
Special Bulletin 209 — 84
Special Bulletin 210 — 34
Special Bulletin 211 — 628
Special Bulletin 212 — 82
Special Bulletin 213 — 149
Special Bulletin 214 — 757
Technical Bulletin 109 — 180
Technical Bulletin 110 — 70
Technical Bulletin 111 — 140
Technical Bulletin 112 — 639
Technical Bulletin 113 — 739
Technical Bulletin 114 — 740
Circular 135 — 150
Circular 136 — 649
Circular 137 — 659

MICHIGAN STATION—Continued.

Quarterly Bulletin, Volume 13— Page

No. 3, February, 1931 413, 433, 436, 437, 456, 458, 461, 468, 469, 470, 473, 475, 478, 479, 486, 496

No. 4, May, 1931 623, 628, 633, 634, 639, 641, 664, 670, 676, 678, 686, 697

Biennial Report, 1929–30 717, 718, 722, 729, 738, 742, 745, 756, 762, 765, 769, 771, 778, 782, 784, 793, 794, 797

Forty-second Annual Report, 1929 153, 164, 174, 175, 198

MINNESOTA STATION:

Bulletin 269 86
Bulletin 270 282
Bulletin 271 42
Bulletin 272 62
Bulletin 273 173
Bulletin 274 365
Bulletin 275 131
Technical Bulletin 71 151
Technical Bulletin 73 177
Thirty-eighth Annual Report, 1930 99

MISSISSIPPI STATION:

Bulletin 285 31, 39, 99
Bulletin 286 126
Bulletin 287 31, 39, 99
Bulletin 288 34
Bulletin 289 131
Bulletin 290 187
Bulletin 291 891
Circular 94 65

MISSOURI STATION:

Bulletin 295 72
Bulletin 296 332
Bulletin 297 385
Bulletin 298 422
Bulletin 299 330
Bulletin 301 340
Bulletin 302 387
Bulletin 303 676
Bulletin 304 881
Bulletin 305 856
Research Bulletin 151 485
Research Bulletin 152 20
Research Bulletin 153 841

MONTANA STATION:

Bulletin 239 187
Bulletin 240 19
Bulletin 241 138
Bulletin 242 554
Bulletin 243 576
Bulletin 244 583
Bulletin 245 527
Bulletin 246 715
Bulletin 247 761

NEBRASKA STATION: Page
Bulletin 253 482
Bulletin 254 575
Bulletin 255 676
Bulletin 256 660
Bulletin 257 660
Bulletin 258 887
Bulletin 259 859
Research Bulletin 51 346
Research Bulletin 52 148
Research Bulletin 53 348
Research Bulletin 54 262
Research Bulletin 55 862
Research Bulletin 56 898
Research Bulletin 57 827
Forty-fourth Annual Report [1930] 809,
822, 829, 837, 854, 857, 858, 860, 862, 878, 899

NEVADA STATION:
Bulletin 121 668
Bulletin 122 662
Annual Report, 1930 720, 761, 763, 767, 772, 775, 797

NEW HAMPSHIRE STATION:
Bulletin 255 278
Technical Bulletin 45 857
Technical Bulletin 46 846
Circular 36 578
Scientific Contribution 29 341
Scientific Contribution 30 64
Scientific Contribution [31] 341
Scientific Contribution [32] 341

NEW JERSEY STATIONS:
Bulletin 510 54
Bulletin 511 41
Bulletin 512 31
Bulletin 513 40
Bulletin 514 23
Bulletin 515 83
Bulletin 516 39
Bulletin 517 23
Bulletin 518 23
Bulletin 519 621
Bulletin 520 448
Bulletin 521 781
Bulletin 522 751
Bulletin 523 243
Bulletin 524 857
Circular 226 352
Circular 227 42
Circular 228 42
Circular 229 436
Circulars 230–245 352
Circular 246 342

	Page
New Jersey Stations—Continued.	
Circular 247	368
Circular 248	634
Hints to Poultrymen, volume 19—	
No. 6, March, 1931	473
No. 7, April, 1931	465
No. 8, May, 1931	578
No. 9, June, 1931	578
Report, 1930	810, 816, 824, 829, 830, 831, 833, 834, 835, 837, 841, 842, 847, 860, 863, 864, 866, 872, 874, 879, 882, 899
New Mexico Station:	
Bulletin 188	187
Bulletin 189	32
Bulletin 190	118
Bulletin 191	527
Bulletin 192	535
Bulletin 193	534
Bulletin 194	760
Forty-first Annual Report, 1930	211, 221, 227, 234, 244, 255, 256, 259, 272, 288, 299
New York Cornell Station:	
Bulletin 515	53
Bulletin 516	173
Bulletin 517	137
Bulletin 518	284
Bulletin 519	641
Bulletin 520	621
Bulletin 521	635
Bulletin 522	795
Bulletin 523	785
Bulletin 524	786
Bulletin 525	783
Memoir 135	216
New York State Station:	
Bulletin 590	148
Bulletin 591	373
Bulletin 592	332
Bulletin 593	373
Bulletin 594	323
Bulletin 595	807
Technical Bulletin 172	21
Technical Bulletin 173	17
Technical Bulletin 174	374
Technical Bulletin 175	447
Technical Bulletin 176	635
Technical Bulletin 177	741
Technical Bulletin 178	712
Technical Bulletin 179	712
Technical Bulletin 180	866
Technical Bulletin 181	807

NORTH CAROLINA STATION: Page
Bulletin 277 782
Technical Bulletin 39 467
Technical Bulletin 40 180
Agronomy Information Circular 60 118
Fifty-third Annual Report, 1930 114, 118, 122, 126, 131, 136, 145, 153, 158, 159, 160, 164, 168, 170, 173, 179, 180, 188, 198

NORTH DAKOTA STATION:
Bulletin 243 338
Bulletin 244 39
Bulletin 245 184
Bulletin 246 618
Bulletin 247 133

OHIO STATION:
Bulletin 471 129
Bulletin 472 139
Bulletin 473 154
Bulletin 474 285
Bulletin 475 338
Bulletin 476 560
Bulletin 477 892
Bulletin 478 837, 852
Bulletin 479 833
Bulletin 480 820
Bulletin 481 883
Bimonthly Bulletin 150 433, 435, 448, 467, 475, 481
Bimonthly Bulletin 151 638, 641, 659, 661, 678, 696
Special Circular 32 166
Special Circular 33 475
Forest News, No. 13, May, 1931 437
Forest News, No. 14, July, 1931 644

OKLAHOMA STATION:
Bulletin 195 285
Bulletin 198 278

[OKLAHOMA] PANHANDLE STATION:
Panhandle Bulletin 26 129, 171
Panhandle Bulletin 27 330, 341, 362
Panhandle Bulletin 28 464
Panhandle Bulletin 29 734, 767

OREGON STATION:
Bulletin 274 282
Bulletin 275 616
Bulletin 276 659
Bulletin 277 740
Bulletin 278 788
Bulletin 279 738
Bulletin 280 750
Bulletin 281 747
Bulletin 282 750
Bulletin 283 787

	Page
OREGON STATION—*Continued.*	
Bulletin 284	738
Bulletin 285	731
Bulletin 286	826
Bulletin 287	885
Circular 100	477
Circular 101	160
Circular 102	575
Circular 103	534
Circular 104	861
Circular 105	815
PENNSYLVANIA STATION:	
Bulletin 261	229
Bulletin 262	279
Bulletin 263	277
Bulletin 264	815
Bulletin 265	887
PORTO RICO STATION:	
Bulletin 34	741
PORTO RICO DEPARTMENT OF AGRICULTURE AND LABOR STATION:	
Circular 92 (Spanish edition)	150
Circular 93 (Spanish edition)	436
RHODE ISLAND STATION:	
Bulletin 228	820
Annual Feed Circular, 1931	553
Annual Fertilizer Circular, 1930	816
Forty-third Annual Report [1930]	510, 511, 526, 534, 572, 579, 598
SOUTH CAROLINA STATION:	
Bulletin 269	80
Bulletin 270	188
Bulletin 271	155
Bulletin 272	371
Bulletin 273	556
Bulletin 274	661
Circular 44	496
Circular 45	83
Circular 46	187
Circular 47	583
SOUTH DAKOTA STATION:	
Bulletin 255	187
Bulletin 256	629
TENNESSEE STATION:	
Circular 36	150
Circular 37	149
Forty-third Annual Report, 1930	825, 830, 840, 850, 856, 861, 899
TEXAS STATION:	
Bulletin 422	294
Bulletin 424	332
Bulletin 425	615
Bulletin 426	615

TEXAS STATION—Continued. Page
Bulletin 427 678
Circular 59 813, 817, 841, 899

UTAH STATION:
Bulletin 224 117
Bulletin 225 207, 222, 229
Bulletin 226 432
Bulletin 227 689
Bulletin 228 627
Bulletin 229 679
Bulletin 230 627
Circular 93 226
Circular 94 670

VERMONT STATION:
Bulletin 311 436
Bulletin 312 469
Bulletin 313 564
Bulletins 314–318 562
Bulletin 319 (Forty-third Annual Report, 1930) 513, 534, 539, 561, 579, 598
Bulletin 320 516
Bulletin 321 553
Bulletin 322 532
Bulletin 323 516
Bulletin 324 553
Bulletin 325 641
Bulletin 326 664
Bulletin 327 688

VIRGIN ISLANDS STATION:
Report, 1930 714, 729, 737, 758, 797

VIRGINIA STATION:
Bulletin 274 391
Bulletin 276 42
Bulletin 277 40
Bulletin 278 739
Technical Bulletin 42 774
A Farm Business Survey of the Early Potato Section of Virginia—
1928 Season, E. Rauchenstein and J. J. Vernon 483
1929 Season, J. J. Vernon and E. Rauchenstein 483

VIRGINIA TRUCK STATION:
Bulletin 71 156

WASHINGTON COLLEGE STATION:
Bulletin 247 154
Bulletin 248 197
Bulletin 249 138
Bulletin 250 348
Bulletin 251 287
Bulletin 252 652
Bulletin 253 750

WESTERN WASHINGTON STATION:
Bulletin 19–W 138

Page

WEST VIRGINIA STATION:
Bulletin 240 — 41
Bulletin 241 — 287
Bulletin 242 — 633
Circular 59 — 734
[Report, 1928-1930] — 299

WISCONSIN STATION:
Bulletin 418 — 40
Bulletin 419 — 64
Bulletin 420 (Annual Report, 1930) — 421, 422, 424, 431, 435, 437, 440, 449, 452, 459, 460, 461, 462, 465, 468, 470, 477, 481, 490, 491, 492, 496
Research Bulletin 103 — 83
Research Bulletin 104 — 132
Research Bulletin 105 — 333
Research Bulletin 106 — 443
Research Bulletin 107 — 446
Research Bulletin 108 — 374
Research Bulletin 109 — 644

WYOMING STATION:
Bulletin 177 — 747
Bulletin 178 — 762
Bulletin 179 — 739
Bulletin 180 — 787
Bulletin 181 — 731
Bulletin 182 — 766
Circular 24 — 233
Fortieth Annual Report, 1930 — 111, 118, 127, 157, 159, 160, 166, 168, 171, 176, 191, 195, 198

UNITED STATES DEPARTMENT OF AGRICULTURE

PUBLICATIONS ABSTRACTED

Technical Bulletin—
217. Beef Production and Quality as Affected by Grade of Steer and Feeding Grain Supplement on Grass, W. H. Black, K. F. Warner, and C. V. Wilson — 364
218. Inheritance of Winter Hardiness, Growth Habit, and Stem-Rust Reaction in Crosses Between Minhardi Winter and H-44 Spring Wheats, K. S. Quisenberry — 37
219. Mountain-Laurel (*Kalmia latifolia*) and Sheep Laurel (*Kalmia angustifolia*) as Stock-Poisoning Plants, C. D. Marsh and A. B. Clawson — 177
220. A Study of the Influence of Herbaceous Plant Cover on Surface Run-off and Soil Erosion in Relation to Grazing on the Wasatch Plateau in Utah, C. L. Forsing — 477
221. Wild Duck Foods of North Dakota Lakes, F. P. Metcalf — 151
222. Genetic Growth Differentiation in Guinea Pigs, H. C. McPhee and O. N. Eaton — 28
223. Reproduction on Pulpwood Lands in the Northeast, M. Westveld — 141
224. Habits and Economic Status of the Pocket Gophers, T. H. Scheffer — 49

Technical Bulletin—Continued. Page
225. Results of Fertilizer Experiments on Norfolk Fine Sandy Loam and on Norfolk Sandy Loam, J. J. Skinner 22
226. The Distribution and the Mechanical Properties of Alaska Woods, L. J. Markwardt 42
227. Developmental Stages of Some Nematodes of the Spiruroidea Parasitic in Poultry and Game Birds, E. B. Cram 161
228. Character of the Colloidal Materials in the Profiles of Certain Major Soil Groups, M. S. Anderson and H. G. Byers 18
229. Variations of the Colloidal Material Extracted from the Soils of the Miami, Chester, and Cecil Series, R. S. Holmes and G. Edgington 18
230. *Macrocentrus gifuensis* Ashmead, a Polyembryonic Braconid Parasite in the European Corn Borer, H. L. Parker 156
231. A Revision of the American Species of Empoasca Known to Occur North of Mexico, D. M. DeLong 54
232. A Laboratory Study of the Field Percolation Rates of Soils, C. S. Slater and H. G. Byers 19
233. *Apanteles thompsoni* Lyle, a Braconid Parasite of the European Corn Borer, A. M. Vance 252
234. Marketing Apples Grown in the Cumberland-Shenandoah Region of Pennsylvania, Virginia, and West Virginia, C. R. Swinson, J. J. Vernon, F. F. Lininger, F. P. Weaver, and A. J. Dadisman 189
235. Quality of Alfalfa Hay in Relation to Curing Practice, T. A. Kiesselbach and A. Anderson 129
236. The Time to Harvest Fiber Flax, B. B. Robinson 224
237. Economic Factors Affecting the Beef-Cattle Industry of Virginia, C. A. Burmeister, H. M. Conway, and A. P. Brodell 282
238. The Pharmacology of Thallium and Its Use in Rodent Control, J. C. Munch and J. Silver 151
239. A Method of Determining the Volume and Tonnage of Haystacks, W. H. Hosterman 577
240. The Chemical Eradication of Ribes, H. R. Offord 448

Farmer's Bulletin—
1642. Chalcid Control in Alfalfa-Seed Production, V. L. Wildermuth 552
1644. Local Bird Refuges, W. L. McAtee 50
1656. Peanut Growing, W. R. and J. H. Beattie 225
1657. The Great Basin Wireworm in the Pacific Northwest, M. C. Lane 58
1658. Farm Water Power, G. M. Warren 74
1659. Oats in the Northeastern States, T. R. Stanton and F. A. Coffman 132
1660. The Use of Logs and Poles in Farm Construction, T. A. H. Miller 479
1661. Farm Study of the Cotton Plant, J. W. Hubbard 131
1662. Husker-Shredders in Corn-Borer Control, I. F. Reed and W. R. Humphries 184
1663. Winter Legumes for Green Manure in the Cotton Belt, R. McKee and A. D. McNair 223
1664. Christmas Trees as a Cash Crop for the Farm, F. H. Eyre 743
1665. The Silverfish as a Pest of the Household, E. A. Back 757

Statistical Bulletin— Page
32. Stumpage and Log Prices for the Calendar Year 1928, compiled by H. B. Steer 43
33. Cold-Storage Holdings 784

Circular—
143. Some Common Mushrooms and How to Know Them, V. K. Charles 138
144. Farmers' Experiences and Opinions as Factors Influencing Their Cotton-Marketing Methods, T. B. Manny 85
145. *Tiphia popilliavora* Rohwer, a Parasite of the Japanese Beetle, J. L. King and J. K. Holloway 157
146. Proximate Composition of Fresh Vegetables, C. Chatfield and G. Adams 91
147. The Spread of Cranberry False Blossom in the United States, N. E. Stevens 49
148. Parasites and Parasitic Diseases of Horses, B. Schwartz, M. Imes, and W. H. Wright 72
149. Marketing the Commercial Crop of Early Potatoes, J. W. Park 85
150. The Farm Real Estate Situation, 1929–30, E. H. Wieckling and B. R. Stauber 82
151. Hedging in Grain Futures, J. M. Mehl 684
152. Monantha Vetch, R. McKee, H. A. Schoth, and J. L. Stephens 37
153. Methods of Seed Production from Sugar Beets Overwintered in the Field, J. C. Overpeck and H. A. Elcock 36
154. Anaplasmosis in Cattle, G. W. Stiles, jr 178
155. The Ice Well for the Dairy Farm, J. R. Dawson and A. L. Watt 78
156. Transplanting Sugar Beets in Utah and Idaho, S. B. Nuckols 35
157. Fig Insects in California, P. Simmons, W. D. Reed, and E. A. McGregor 357
158. A Simple Chemical Test for Predetermining the Culinary Quality of Potatoes as Affected by the Accumulation of Soluble Sugars, W. M. Peacock and B. C. Brunstetter 508
159. Extension Work in Cooperative Marketing, B. B. Derrick 190
160. Economic Aspects of Land Settlement in the Cut-Over Region of the Great Lakes States, W. A. Hartman and J. D. Black 278
161. Bulk and Sack Handling of Grain in the Pacific Coast States, E. N. Bates, G. P. Bodnar, and E. J. Stirniman 281
162. Variety Tests of Sugarcanes in Louisiana during the Crop Year 1928–29, G. Arceneaux and R. T. Gibbens 132
163. Manufacture of Dimension Stock from Northern Hardwoods, A. O. Benson 437
164. An Apparatus for Determining the Tenderness of Certain Canned Fruits and Vegetables, V. B. Bonney, P. A. Clifford, and H. A. Lepper 190

Leaflet—
72. Measuring Hay in Stacks, W. H. Hosterman 77
73. Is the Public Market a Good Civic Investment? C. B. Sherman 585
74. Boning Lamb Cuts, K. F. Warner 689
75. Warts on Cattle, G. T. Creech 673
76. Slip Covers, B. M. Viemont 696
77. Bracing Farm Buildings, G. W. Trayer and M. C. Betts 881
78. Hints on Bobcat Trapping, S. P. Young 845

Miscellaneous Publications— Page
99. Government Forest Work in Utah 141
100. Workers in Subjects Pertaining to Agriculture in State Agricultural Colleges and Experiment Stations, 1930–1931, M. A. Agnew 190
101. Important Western Browse Plants, W. A. Dayton 817
106. Pine-Tree Treasures, N. Owen 233
107. An Explanation of American Lumber Standards, C. V. Sweet 142
108. The Agricultural Outlook for 1931 81
109. Forest Rangers' Catechism: Questions and Answers on the National Forests of the California Region, R. W. Ayres and W. I. Hutchinson 743
110. Glossary of Botanical Terms Commonly Used in Range Research, compiled by W. A. Dayton 623
111. Motion Pictures of the United States Department of Agriculture, 1931 688
112. The Farm Outlook for 1931 81
113. Adequate Diets for Families with Limited Incomes, H. K. Stiebeling and M. Birdseye 192
114. The Weather Bureau, compiled by E. B. Calvert 509
115. Information for the Guidance of Field Men and Cooperators of the Bureau of Biological Survey Engaged in the Control of Injurious Rodents and Predatory Animals, P. G. Redington and S. P. Young 242
116. Rural Standards of Living: A Selected Bibliography, compiled by L. O. Bercaw 786

Inventory—
100. Plant Material Introduced by the Office of Foreign Plant Introduction, Bureau of Plant Industry, July 1 to September 30, 1929 324
101. Plant Material Introduced by the Division of Foreign Plant Introduction, Bureau of Plant Industry, October 1 to December 31, 1929 623

Yearbook, 1931 482, 486, 496

Crops and Markets—
Volume 8—
No. 3, March, 1931 189
No. 4, April, 1931 280
No. 5, May, 1931 486
No. 6, June, 1931 686
No. 7, July, 1931 784
No. 8, August, 1931 886

OFFICE OF EXPERIMENT STATIONS:
Report on the Agricultural Experiment Stations, 1930, W. H. Beal et al 796

EXTENSION SERVICE:
Circular 147, Education Values in 4-H Club Work, E. H. Shinn 687
Circular 168, The Outlook for Land Utilization in the United States, O. E. Baker 883
Cooperative Extension Work, 1929 488

BUREAU OF AGRICULTURAL ECONOMICS:

	Page
Agricultural Economics Bibliography—	
No. 11 (rev.), Economic Periodicals of Foreign Countries Published in the English Language: A Selected List, compiled by L. O. Bercaw, rev. by M. I. Herb	185
No. 31, Part 1, Section 2, California: An Index to the State Sources of *Agricultural Statistics*.—Part I, Fruits, Vegetables, and Nuts, Section 2, compiled by L. O. Bercaw	584
No. 31, Part 2, California: An Index to the State Sources of Agricultural Statistics.—Part II, Crops Other Than Fruits, Vegetables, and Nuts, compiled by L. O. Bercaw	584
No. 33, Wheat: Cost of *Production, 1923–1930*, compiled by L. O. Bercaw	484
Agricultural Economics Charts	80
A Survey of the United States Bulb Industry, R. G. Hill	642
An Analysis of the South Carolina Agricultural Loan Association, W. H. Rowe	682
Farm Prices of Cotton Related to Quality, Arkansas Crop, Season 1928–1929, L. D. Howell	684
Statistics and Charts of the *Poultry* and Egg Industry, compiled by E. R. Johnson	84
Statistics of Meat Production, Consumption, and Foreign Trade of *the United States*, 1900–1930	686
Tariff Rates on Representative Agricultural Products under Tariff Acts of 1930 and 1922, C. F. Wells	783
The Outlook for the Dairy Industry	81
The Texas Cotton Growers' Finance Corporation, W. H. Rowe	682

BUREAU OF BIOLOGICAL SURVEY:

Alaska Game Commission Circulars 7 and 8, Laws and Regulations Relating to Game, Land Fur-Bearing Animals, and Birds in Alaska, [1930–31, 1931–32]	151

BUREAU OF CHEMISTRY AND SOILS:

An Index of Patented Mothproofing Materials, R. C. Roark	359
Excerpts from Consular Correspondence Relating to Insecticidal and Fish-Poison Plants, R. C. Roark	846
[Soil Survey Report], Series 1925—	
No. 34. Soil Survey of St. Lawrence County, New York, C. *Lounsbury et al*	417
[Soil Survey Reports], Series 1926—	
No. 23. Soil Survey of Claiborne County, Mississippi, B. H. Hendrickson and J. E. McKeehen	16
No. 24. Soil Survey of the Arkansas Valley Area, Colorado, A. T. Sweet and W. Inman	208
No. 25. Soil Survey of Wadena County, Minnesota, J. A. Elwell et al	16
No. 26. Soil Survey of Clay County, Kansas, J. Thorp et al	16
No. 27. Soil Survey of Rankin County, Mississippi, R. Wildermuth et al	16
No. 28. Soil Survey *of the Camden Area, New Jersey*, R. T. A. Burke and L. L. Lee	116
No. 29. Soil Survey of Tuscola County, Michigan, E. B. Deeter and A. E. Matthews	116

BUREAU OF CHEMISTRY AND SOILS—Continued.
[Soil Survey Reports], Series 1926—Continued. Page
No. 30. Soil Survey of Labette County, Kansas, E. W. Knobel et al 16
No. 31. Soil Survey of Franklin County, Nebraska, F. A. Hayes et al 16
No. 32. Soil Survey of the Salt River Valley Area, Arizona, W. G. Harper et al 116
No. 33. Soil Survey of Buchanan County, Iowa, T. H. Benton et al 208
No. 34. Soil Survey of Manitowoc County, Wisconsin, A. C. Anderson et al 417
No. 35. Soil Survey of Lincoln County, Nebraska, A. W. Goke et al 715
No. 36. Soil Survey of Custer County, Nebraska, F. A. Hayes et al 715
[Soil Survey Reports], Series 1927—
No. 9. Soil Survey of Hampshire County, West Virginia, B. H. Williams 116
No. 10. Soil Survey of Hamilton County, Nebraska, A. W. Goke and W. H. Buckhannan 116
No. 11. Soil Survey of Lyon County, Iowa, A. M. O'Neal *et al* 208
No. 12. Soil Survey of Butler County, Ohio, E. D. Fowler and T. C. Green 619
No. 13. Soil Survey of the Clear Lake Area, California, E. J. Carpenter et al 619
[Soil Survey Reports], Series 1928—
No. 2. Soil Survey of the Deming Area, New Mexico, A. T. Sweet and E. N. Poulson 117
No. 3. Soil Survey of Crawford County, Kansas, M. H. Layton *et al* 417

FOREST SERVICE:
Forest Taxation Inquiry Progress Report—
11. Tax Delinquency in the Selected Counties of Oregon and Washington, D. Pingree 186
12. Assessment Ratios of Forest Property and Other Real Estate in Wisconsin, R. C. Hall 186
Digest of State Forest Tax Laws (rev., 1931) 343

BUREAU OF PUBLIC ROADS:
Highways in the United States of America and Its Possessions 778
Public Roads—
Volume 11, No. 12, February, 1931 74
Volume 12—
No. 1, March, 1931 478
No. 2, April, 1931 478
No. 3, May, 1931 575
No. 4, June, 1931 779
No. 5, July, 1931 779

WEATHER BUREAU:
Monthly Weather Review—
Volume 58—
Nos. 11–12, November–December, 1930 15

WEATHER BUREAU—Continued.

Monthly Weather Review—Continued.

Volume 59— Page

No. 1, January, 1931 316

No. 2, February, 1931 316

No. 3, March, 1931 616, 617, 618

No. 4, April, 1931 618

No. 5, May, 1931 807

No. 6, June, 1931 807, 808

Climatological Data—

Volume 17—

Nos. 11–12, November–December, 1930 15

No. 13, 1930 316

Volume 18—

Nos. 1–2, January–February, 1931 414

Daily River Stages, volume 27, 1929 74

JOURNAL OF AGRICULTURAL RESEARCH

Volume 42—

No. 4, February 15, 1931 127, 177, 178

No. 5, March 1, 1931 323, 327, 329, 345, 352

No. 6, March 15, 1931 323, 326, 366

No. 7, April 1, 1931 362, 363, 379

No. 8, April 15, 1931 325, 331, 338, 361, 397

No. 9, May 1, 1931 423, 445, 447, 457, 466

No. 10, May 15, 1931 623, 629, 630, 631, 636, 663, 667

No. 11, June 1, 1931 715, 720, 724, 730, 739, 747

No. 12, June 15, 1931 716, 748, 759, 767, 779

Volume 43—

No. 1, July 1, 1931 734, 738, 742, 750, 758, 764

EXPERIMENT STATION RECORD

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EDITORIAL

OPPORTUNITIES FOR ENGINEERING RESEARCH IN AGRICULTURE

By R. W. Trullinger, *Assistant in Experiment Station Administration, Senior Agricultural Engineer, Office of Experiment Stations*

Agricultural engineering consists of the application of civil, mechanical, electrical, and chemical engineering principles and certain physical and physicochemical phenomena to agricultural operations and practices. Its purpose is to introduce efficiency and economy into the agricultural industry.

Research in agricultural engineering has been made necessary by the fact that the requirements of the agricultural industry for engineering are peculiar and exacting. They often differ markedly from those of other industries in that the matters for manipulation are largely of a biological character. Individual units of the industry also are usually comparatively small.

In undertaking research in the subject efforts have been made not only to attain the most extensive and profitable application possible of available engineering principles to agriculture, but to modify materially many of them to meet specific agricultural requirements more effectively. In some cases it has been necessary to develop entirely new and distinctive principles.

Much has already been accomplished in this field at the agricultural experiment stations. No fewer than 40 of these stations have built up a program in agricultural engineering which includes more than 300 projects. The stations are adopting an attitude of sympathetic encouragement toward this work, and they are also giving cooperation by supplying basic agricultural requirements for engineering assistance.

Most agricultural research institutions are handicapped, however, by limited facilities for engineering research. It is recognized, therefore, that this movement probably could still better attain its objective with the cooperation of the engineering experiment stations, and in perhaps the majority of cases with their active participation.

The opportunities for participation of this character in the present program are numerous and attractive.

Thus, in the field of power and mechanical equipment, the value of such equipment on farms in the United States has increased fourfold during the past 20 years, and the wealth produced per agricultural worker has shown a parallel and proportionate increase. Nevertheless, the total annual cost of primary power used on farms in the United States is approaching the four billion dollar mark, and power and labor costs still are generally estimated at 60 per cent of the total cost of agricultural production.

It is significant to note in this connection that the fundamental principles of design of many of the large power-consuming farm machines, such as the plow, are still largely unknown. For this reason, while considerable economy and increased efficiency have resulted in a general way through the mechanization of agriculture, the program of engineering research in the subject is aimed at the development of the important specific details of mechanical equipment along cost-saving lines of a permanent character. There are 132 such research projects active at 33 agricultural experiment stations.

Probably the greatest general power-consuming agricultural operation is tillage, which in some cases requires from one-half to two-thirds of the total power consumed in the production of a crop. Efforts to reduce this power consumption by better management have been attended with considerable success in the aggregate, but there is still necessity for directing more attention toward some of the details, and 14 projects in the subject are now active at 13 agricultural experiment stations.

Considerable now is known regarding the tilth requirements of different crops and those engineering properties of certain soils which govern tillage operations. With this knowledge it is becoming possible to design a plow or other tillage tool to overcome such specific engineering factors of certain soils as internal and external friction, shearing resistance, cohesion, and the like, and produce a given required degree of tilth with a minimum expenditure of power for draft. The necessity for extensive and profound researches in engineering physics, mechanics, and metallurgy, in connection with such studies of soil dynamics and their relation to tillage implement design, has limited this sort of work to a very few agricultural experiment stations. This very necessity would seem to place these features of these studies definitely in the field of the engineering experiment stations, in cooperation with departments of agricultural engineering, agronomy, and soil technology.

Although the tractor was developed originally to supply the draft and other power for tillage and harvesting operations, in the peculiar

and sometimes very severe requirements of agricultural service it often has not been efficiently or economically adaptable. This has called for the redevelopment of tractors in numerous specific details to meet certain of the severe requirements imposed by individual agricultural operations. Sixteen studies of traction machinery are now active at 13 agricultural experiment stations.

Traction studies to meet the draft requirements for field operations in soils with poor traction characteristics, for example, are aimed at the elucidation of the principles of design of drivewheels. Such studies involve a consideration of the distribution and concentration of tractive impulse stresses in soil from drivewheel rims and lugs in their relation to the dynamics and kinematics of the tractor as a whole, and necessitate fundamental studies in engineering physics, mechanics, kinematics, and metallurgy.

The requirements of agricultural service also call for different conditions of carburetion, fuel composition, and gaseous explosion for optimum tractor performance. Since American agriculture uses in the neighborhood of 20,000,000,000 h.p. hours of primary power annually, and so large a proportion of it is now mechanical in character, it would seem worth while for the engineering experiment stations to devote some time to studies of tractor fuels and carburetion and combustion problems as they relate to the requirements of specific types of agricultural performance in both draft and power take-off operations. There is an opportunity in this connection to introduce greater economy in power utilization in agriculture, which should be reflected especially in more satisfactory and flexible performance of traction machinery. Similar opportunities are offered in the problems relating to bearing wear, lubrication, intake air cleaning, steering, and other tractor features.

While much has been accomplished along cost-saving lines by the practical combination of the harvesting and threshing operations, it is known that the maximum of efficiency in the combining process has not been attained. Although 20 studies of harvesting and threshing are active at 14 of the agricultural experiment stations, the studies in physics, mechanics, and thermodynamics necessary to develop the principles of design to the point of maximum efficiency offer the engineering experiment stations an attractive opportunity.

Similar opportunities exist with reference to the development of methods and equipment for the harvesting of potatoes and certain other root crops. The mechanical problems of digging, cleaning, elevating, and the like, have not been fully solved. For example, the high depreciation in the oscillating and reciprocating parts operating under very severe conditions of abrasive dusts offers special problems of lubrication and protection.

The importance of maintaining superior quality in grain and hay crops regardless of their condition at the time of harvest or of the weather conditions has been recognized by at least 10 of the agricultural experiment stations. It appears that the ultimate utility and economy of the combine in most States depend largely upon the development of methods and portable equipment for satisfactorily drying combined grain which has ripened nonuniformly or contains green weed seeds. Likewise, the loss of a considerable percentage of the hay crop annually due to bad weather has made the development of artificial dehydration a matter of considerable economic importance in some localities.

Studies of the basic requirements for the proper curing of grain and hay have been undertaken to provide specifications for the development of drying methods and equipment. The tendency is to study the physiological mechanism of the movement of water from different kinds of hays and grains under controlled conditions of temperature and moisture to determine how this process may be controlled most efficiently by artificial means. The development of the efficient utilization of blasts of heated and dried air in this connection and of the mechanical equipment involved would seem to fall within the field of operations of the engineering experiment stations.

The development of mechanical methods and equipment for the handling of dairy products is assuming considerable economic importance owing to the relatively large amount of time, labor, and power consumed in these operations. Progress already has been made at 11 agricultural experiment stations, where 19 projects are in operation on such features as the use of exhaust steam for cleaning and pasteurization, the use of solar heat for water heating, and the precooling of milk before refrigeration, but the engineering experiment stations may likewise aid in thus introducing greater efficiency into the dairy industry.

The necessity for controlled studies with different soils and crops and different types of fertilizers to determine the requirements for the proper handling and placement of fertilizers by machinery has been recognized by 6 agricultural experiment stations in the Corn and Cotton Belts. Seven stations also are making efforts to develop planting methods and machinery for corn and cotton which will meet certain agronomic as well as economic requirements. The problems in physics and mechanics involved in these studies call for laboratory studies, as well as field tests, in which the engineering experiment stations would appear to have a primary interest.

In spite of the vast total investment of nearly $12,000,000,000 in farm structures in the United States, the great majority of these have been built largely without the aid of engineering. The agricultural

experiment stations have acquired an extensive knowledge of the specific agricultural requirements as well as the economic limitations for many of the more important farm buildings, but frequently the principles available from the older branches of engineering are not adapted to their rational design. This seems due in large measure to the relatively small size and necessary arrangement of the individual units and to their peculiar requirements for service. At any rate 75 investigations in the subject are under way at 28 stations.

From the strictly agricultural standpoint animal shelters and poultry and dairy buildings perhaps offer the most important structural problems. It has been found, for example, that housing conditions which control temperature, air movement and supply, and humidity are important factors in the profitableness of the livestock, dairy, and poultry industries. To secure the optimum of these factors, fundamental studies of materials of construction, heating and ventilating equipment, temperature and humidity control, and the physics of air movement are necessary.

In addition, all such animal shelters must be structurally sound and durable. It is known that some of the better types of barn roof construction, for example, are statically indeterminate or practically so, thus reducing the design of such structures to a matter largely of speculation rather than of engineering precision. The necessity for durability and fireproofness, in addition to strength and ultimate economy in space arrangement also is bringing about the development of animal shelters and general-purpose barns of reinforced concrete, tile, sheet steel, and the like, which call for a rigid application of structural engineering principles. Here again the specific agricultural requirements for such structures can be supplied by the agricultural experiment stations, but it would appear to be a logical function of the engineering experiment stations to develop and manipulate the principles of engineering mechanics and structural design which will meet these requirements in the most satisfactory and economical manner.

In the past the practice often has been to build storage structures for fruits, vegetables, and other crops, largely on the basis of empirical knowledge, and to expect and accept passively a percentage of loss or decreased value. Such loss often has been the determining factor in the success of a crop. The tendency at the agricultural experiment stations now is to study the storage requirements of individual crops such as potatoes, sweetpotatoes, apples, beets, carrots, green grain, and soft corn from the physiological, pathological, and biochemical standpoints in order to arrive at a definite basis for the development of the types of storage structures necessary to prevent these losses. Controlled studies of the physics of air movement

and temperature and humidity control, combined with a manipulation of structural mechanics and of the properties of materials of construction to meet specifically the storage requirements of individual crops appear to lie within the field of the engineering experiment stations and to offer opportunities for constructive cooperation.

The National Committee on the Relation of Electricity to Agriculture and its subsidiary State committees have reported that the agricultural use of electricity is now quite extensive and is growing rapidly. In Alabama, for example, the mileage of rural lines owned by one power company increased from 39 in 1924 to 1,495 miles in 1930, and the number of rural customers from 240 to 8,609 during the same period. The same company also reported in January, 1930, that the consumption of electricity by rural customers varies from 600 kw. hours per year per customer on lines less than one year old to 993 kw. hours on lines five years or more old. Similar data from other States indicate substantial development and growth in the agricultural use of electricity over practically the entire United States.

When the concerted movement toward the electrification of American agriculture started in 1924, there was a wealth of electrical engineering information available to agricultural engineers which was susceptible of immediate practical application to agriculture. The problems encountered were largely of a practical rather than of a fundamental character, and until recently such investigation in the subject as was required has been financed and conducted mainly by private agencies. However, the fact that this initial supply of practical engineering information, while relatively large, has not been sufficient to bring about general rural electrification, has indicated the necessity of ultimately developing enough additional uses of electricity in agriculture to make rural electrification fully worth while for all concerned.

A study of the programs at the agricultural experiment stations indicates that in almost every branch of agriculture opportunities are opening for new uses of electricity. These stations already are organizing considerable of a research program on the use of electricity in crop and dairy products processing, disease and insect control, animal nutrition, crop stimulation, poultry production, and even in field operations. Thirty-two projects are now active at 18 stations and some progress has been reported. For example, the development of electrical poultry brooding practices along more efficient lines has made rapid strides, uniformity of temperature, ease of control, and the elimination of considerable labor being some of the advantages gained. In the dairy industry marked progress has been made in the development of electrical refrigeration of milk

with special reference to meeting the requirements of the small dairy farm. Precooling of fresh fruits and vegetables for storage in refrigerator cars and warehouses, and the stimulation of vegetable crops by electric illumination and by the heating of hot beds are other profitable lines along which progress has been made recently. Each instance of this character, on analysis, has been found to call for study by the agricultural specialists concerned in order to establish the requirements for the application of electrical energy, and for research in physics and electrical engineering to develop the corresponding electrical methods and equipment along sound and permanent lines.

Land reclamation, as a branch of agricultural engineering, is considered to include farm drainage and irrigation, land clearing, and soil erosion and run-off prevention. The irrigation and drainage features of land reclamation research, which for a long time were considered to fall exclusively within the field of civil engineering, have taken on a somewhat new aspect since becoming branches of agricultural engineering in the agricultural experiment stations. There are 58 projects in these subjects active at 25 stations.

The drainage investigations have been narrowed from the broad general demonstration type of field drainage experiment to controlled studies of the principles of soil physics and hydraulics governing the movement of water through different soils under the influence of conditions comparable to those produced by drainage equipment installations. The purpose is to provide a sound technological basis for the engineering design of drainage systems to meet the specific requirements of different crops, soils, and climates. Similarly the irrigation studies now are undertaking to secure information relating to the basic requirements of different crop plants for water and to elucidate the physical principles governing the existence, movements, and factors of availability of water to crops in various soils and how these may be controlled by engineering manipulation.

Thus a field of research is offered the engineering experiment stations which extends considerably beyond the consideration of flow of water in tile, pipe lines, flumes, ditches, and canals. It calls for cooperation with plant physiology and soil technology work of the agricultural experiment stations to establish the agricultural requirements for drainage and irrigation, and for the manipulation of soil physics and engineering hydraulics by the engineering experiment stations to provide basically sound principles for the rational and economical design of drainage and irrigation practices and equipment.

The U. S. Department of Agriculture has estimated that not less than 126,000,000,000 lbs. of plant food material are removed from

the fields and pastures of the United States every year by erosion under the influence of storm run-off, representing a loss of in the neighborhood of $200,000,000. Research in this field now calls for cooperation between engineers, soil technologists, and field crop specialists in studies of the basic factors in the erosion of different soils and how they may be controlled by artificial means or by the manipulation of natural processes. The conduct of these studies in field plats and in the laboratory to isolate and control the soil engineering factors responsible for erosion and storm run-off losses offers the engineering experiment stations numerous opportunities.

The main problem in land clearing at present seems to be to adapt the many different available methods and types of equipment to various local conditions at the least cost. Data are now available on the lifting and shattering power of different explosives and on the relative efficiencies of different mechanical clearing devices in terms of the resistance of stumps, stones, and the like, to shattering and removal. However, these processes are at best still very costly, and there is yet much to be accomplished which falls definitely within the field of the engineering experiment stations.

Thus it appears that a total of several hundred projects in agricultural engineering are active at the agricultural experiment stations. Some of these already are cooperative with engineering experiment stations. In a considerable number of others the distinctly engineering features have been organized by agricultural engineers and are ready for active prosecution, but the rapid progress desired has been retarded by the limited facilities for engineering and physical research available. Such cases offer the engineering experiment stations attractive opportunities for profitable participation in research of considerable economic importance. If the research can be adequately organized and supported, the time seems ripe for its effective utilization.

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

Chemical investigations of the tobacco plant.—I, A preliminary study of the non-volatile organic acids of tobacco leaves, H. B. VICKERY and G. W. PUCHER (*Connecticut State Sta. Bul. 323 (1931), pp. 151–202, figs. 2*).—"A procedure for the precipitation of the barium salts of the organic acids by means of alcohol has been devised and found to yield quantitative results with respect to the organic acids of which the esters can be distilled." A further device described consists of efficient and simple continuous ether-extraction apparatus (two types) for large and small quantities of fluid.

"The barium salts precipitate is a complex mixture. The acids may be separated into a number of fractions of which, in the case of tobacco leaves, the organic acids capable of esterification and fractional distillation form less than half. Data are presented on the distribution and qualitative chemical behavior of the other acidic substances. Experimental evidence is presented to show that the ether extraction and esterification method employed by Franzen and his coworkers may be used not only for qualitative but also for approximately quantitative evaluation of the organic acids in extracts from plant tissues.

"The identity of the chief organic acids of Connecticut shade-grown tobacco has been established and their quantitative distribution ascertained. *l*-Malic is the predominating acid of fresh leaves and makes up about 85 per cent of the acids isolated as esters. A considerable part of the remainder is citric acid. Fumaric, succinic, and oxalic acids were found in small amounts. About 10 per cent of the organic acid esters isolated were derived from acids that have not as yet been identified. Citric acid is the predominating acid of tobacco seed. It is accompanied by small amounts of malic and fumaric acids.

"Oxalic acid decreases but does not entirely disappear during the development of the plant, as was found by Smirnow[1] in the case of Oriental tobacco. Malic acid attains its maximum concentration in the young plant and the proportion does not change appreciably in the mature leaf. The concentration decreases during curing. The concentration of citric acid is also maximal in the young plant, decreasing markedly in the mature fresh leaf and again increasing during the curing process."

The mode of combination between certain dyes and gelatin granules, L. M. C. RAWLINS and C. L. A. SCHMIDT (*Jour. Biol. Chem., 88 (1930), No. 1, pp. 271–284, figs. 12*).—The experiments here reported from the University of California Medical School had the object of determining "the effects of concentration of dye, temperature, time, and acidity on the amounts of Biebrich scarlet and of tropeolin O which gelatin granules can take up.

"It is shown that the amounts of dye which gelatin granules absorb are dependent on the time during which the granules are in contact with the dye, the acidity of the solution, and the concentration of dye employed. The

[1] Ztschr. Wiss. Biol., Abt. E, Planta, Arch. Wiss. Bot., 6 (1928), No. 5, pp. 687–766, figs. 10.

experiments show that at the acidities indicated the maximum amounts of the dyes which were taken up by gelatin granules at the maximum periods of time employed were the same as those which were found to combine with gelatin when the latter was in solution. From this fact and the fact that the so-called adsorption curves of gelatin with Biebrich scarlet and tropeolin O at the longer periods of time when plotted logarithmically are not straight lines, it is concluded that the phenomenon is not one of adsorption but is dependent upon primary chemical forces. A tentative hypothesis is advanced to explain the S-shaped curves (i. e., the protective colloidal effect) which were obtained when varying amounts of dye were added to gelatin solutions."

Studies on the mode of combination of iron with certain proteins, amino acids, and related compounds, C. V. Smythe and C. L. A. Schmidt (*Jour. Biol. Chem., 88 (1930), No. 1, pp. 241–269, figs. 7*).—The following classes of substances were found, in an investigation here reported from the University of California Medical School, apparently to possess within the molecule a grouping causing them to hold iron as an undissociated compound: Hydroxymonocarboxylic acids (lactic, gluconic); dicarboxylic acids (oxalic, malonic); hydroxydicarboxylic and hydroxytricarboxylic acids (tartaric citric); amino acids which are also hydroxy or dicarboxylic acids (aspartic acid, serine); certain inorganic acids (phosphoric, arsenic); certain phosphorus-containing compounds (nucleic acid, glycerophosphoric acid); and certain proteins (casein, gelatin).

"A correlation of the amount of iron bound by casein and gelatin with the groupings that are known to occur in their molecules is reported. An explanation, based on the residual charge of atoms, is suggested for the manner in which the iron may be united." Theoretically possible structures of the complexes formed by iron with the thiocyanate and phosphate groupings and with the oxalate and other organic acid groupings are shown.

The apparent dissociation constants of arginine and of lysine and the apparent heats of ionization of certain amino acids, C. L. A. Schmidt, P. L. Kirk, and W. K. Appleman (*Jour. Biol. Chem., 88 (1930), No. 1, pp. 285–293, figs. 2*).—The apparent dissociation constants of arginine and of lysine at 25° C. and of arginine, lysine, histidine, and aspartic and glutamic acids at 0° have been determined; and, "on the basis of these data and certain others cited in the text the apparent heats of ionization of arginine, histidine, lysine, aspartic acid, and glutamic acid have been calculated."

The prolamins of dwarf yellow milo and feterita, two horticultural varieties of Holcus sorghum, D. B. Jones and F. A. Csonka (*Jour. Biol. Chem., 88 (1930), No. 1, pp. 305–309*).—Prolamin was found, in the study here reported from the Protein and Nutrition Division, Bureau of Chemistry and Soils, U. S. D. A., to be the predominant protein type of the seed of milo and feterita, as it had previously been shown, by the same laboratory (E. S. R., 37, p. 8), to be in the seed of the third horticultural variety, kafir, of the same species.

"The prolamins of these seeds differ only slightly in their elementary composition and in the distribution of their nitrogen as determined by the Van Slyke method [E. S. R., 26, p. 22]. The milo prolamin, however, is characterized by its lack of tryptophane," as indicated by the May and Rose method (E. S. R., 48, p. 312), modified by the authors of the present contribution. "The feterita prolamin, on the other hand, was found to contain 1.29 per cent.

"A globulin fraction precipitable from 10 per cent sodium chloride extracts of the meals at 47 to 50 per cent of saturation with ammonium sulfate was found in small quantities in each of the three varieties. The presence of glutelin could not be demonstrated."

Note on a previously unrecorded occurrence of crystalline globulin in banana seeds, G. L. KEENAN and J. D. WILDMAN (*Jour. Biol. Chem., 88 (1930), No. 1, pp. 425, 426, figs. 2*).—"The crystals . . . are located in the cells of the endosperm, usually one crystal in a cell, and embedded in, or surrounded by, a compact mass of very small starch grains, these starch masses having the shape of the cell in which they are located. . . . In size the crystals were found to vary from 15μ to 50μ with an average of 32μ. . . . The regular octahedra can be readily examined by powdering the starchy endosperm and mounting in a suitable menstruum. These octahedra . . ., like those of the squash and cantaloupe seeds, were found to have an n=approximately 1.545. Their identity was also confirmed by the usual microchemical tests for proteins." Two photomicrographs illustrate the note.

The structure of glutathione, B. H. NICOLET (*Jour. Biol. Chem., 88 (1930), No. 1, pp. 389–393*).—In a contribution from the U. S. D. A. Bureau of Dairy Industry account is given of the condensation of glutathione, in the reduced form, as prepared from yeast, with ammonium thiocyanate and acetic anhydride, and of the further condensation of the bisthiohydantoin with benzaldehyde; and the theoretical considerations involved in these reactions are briefly discussed.

Thiohydantoins derived from cystine and from cysteine, B. H. NICOLET (*Jour. Biol. Chem., 88 (1930), No. 1, pp. 395–401*).—From the same source as the preceding contribution, the present paper notes that attempts to prepare thiohydantoins from cystine and from cysteine have not been successful, the usual method for the preparation of thiohydantoins not being applicable directly to cystine. "This, however, appears to be due only to the extreme insolubility of cystine in acetic anhydride, which prevents its normal acetylation under such conditions. When cystine is acetylated in alkaline aqueous solution . . . , the residue obtained on evaporation of this solution to dryness (at 10 to 20 mm.) reacts readily with ammonium thiocyanate in acetic anhydride, and thiohydantoin formation takes place." Brief account is given of the preparation of N-acetylcystine, cystine-bis-1-acetyl-2-thiohydantoin, and cysteine-1-S-diacetyl-2-thiohydantoin.

The action of alkali on thiohydantoin derivatives of cystine and cysteine, B. H. NICOLET (*Jour. Biol. Chem., 88 (1930), No. 1, pp. 403–407*).—"The action of alkali on the acetylated thiohydantoins derived from cystine and from cysteine [noted in the preceding paper] has been described, and the constitution of the products discussed. It is believed that acquaintance with these products will permit the extension of the method of Schlack and Kumpf for the determination of the structure of polypeptides to peptides containing cysteine."

Enzyme purification: Further experiments with pancreatic amylase, H. C. SHERMAN, M. L. CALDWELL, and M. ADAMS (*Jour. Biol. Chem., 88 (1930), No. 1, pp. 295–304*).—A new method for the purification of pancreatic amylase, which involves adsorption by alumina gel and subsequent precipitation by alcohol and ether and yields dry solid preparations, is detailed in this contribution from the department of chemistry, Columbia University, the work being an extension of earlier investigations (E. S. R., 58, p. 802; 60, pp. 11, 12). "The yields of purified pancreatic amylase obtained by the method here described are larger, and these enzyme preparations are slightly more active, than those obtained by the Sherman-Schlesinger method."

It was found that "the hydrogen ion activities of the solutions at the different steps in the process have a decided influence upon the results obtained, and may be controlled and made reproducible by the presence of 0.01 M phosphate. . . . Sligthly acid solutions, pH 5.2 to 6.0, favor the adsorption of

the amylase by alumina gel, and slightly alkaline solutions, about pH 7.3, favor the extraction of the amylase from the alumina gel by which it has been adsorbed. This is in accord with the view that pancreatic amylase is of amphoteric nature.

"It has been found possible to make use of glycerol in the early stages of the purification where it prevents or decreases the loss of activity of the amylase in solution and to omit its use in the later stages, after the adsorption, where it interferes with the precipitation of dry solid preparations. The active amylase may be effectively separated from glycerol by adsorption, but not by dialysis."

Studies of the intermediate products formed during the hydrolysis of urea by urease, J. B. SUMNER, D. B. HAND, and R. G. HOLLOWAY (*Jour. Biol. Chem., 91 (1931), No. 1, pp. 333–341, figs. 5*).—The data obtained in this investigation, reported from the Medical College of Cornell University, showed that cyanate is not formed during the hydrolysis of urea by urease, that when urea is acted on by urease in alkaline solution ammonium carbamate is formed in large amount, and that the carbamate spontaneously decomposes at a measurable rate; and confirmed the earlier finding that carbonic acid delays the decomposition of carbamate.

"No carbamate is formed by urease in the presence of buffers. There is no reason to doubt that ammonium carbamate is an intermediate product of the action of urease on urea, but it is not necessarily the first intermediate product."

The determination of manganese in animal materials, J. T. SKINNER and W. H. PETERSON (*Jour. Biol. Chem., 88 (1930), No. 1, pp. 347–351*).—Serious difficulty was encountered by the authors of this contribution from the University of Wisconsin in the determination of manganese in rats used in manganese metabolism experiments by reason of the precipitation of calcium sulfate. The periodate method was accordingly modified to the following procedure:

"The porcelain dishes in which the material is to be ashed must be extracted with dilute HCl (1:4) prior to use. Ash the material in a muffle furnace at a cherry-red heat. To the contents of the dish add 5 cc. of sirupy phosphoric acid and sufficient distilled water (30 to 50 cc.) to permit thorough extraction of the ash, and heat on the water bath for about 30 minutes. Allow the dish to cool and then filter the extract through quantitative filter paper or manganese-free asbestos. Transfer the filtrate to a 250-cc. beaker, add approximately 0.3 gm. of KIO_4, and boil gently until the full development of the permanganate color takes place. Cool to about 40°, transfer to a Nessler tube, dilute to the mark, and mix by pouring back into the original beaker and again into the Nessler tube. Compare at once with a similarly treated standard of approximately the same strength. Two standards should be prepared and the one nearest the unknown should be used for comparison.

"Fold a piece of white paper so that it forms an inverted V and reflects the maximum amount of light vertically and place on a larger sheet of white paper. Pour the lighter colored solution into one Nessler tube, and while holding this and the empty tube over the reflector pour the stronger solution into the second tube until the colors of the two tubes match. With a rule graduated in millimeters measure the column of liquid in each tube. Pour out some of the stronger solution and again match the two solutions. Readings should check within 2 or 3 mm. This simple method of matching the colors avoids the necessity of preparing a large number of standards."

The determination of arginine in dog blood, C. J. WEBER (*Jour. Biol. Chem., 88 (1930), No. 1, pp. 353–359*).—The experiments on the determination of

arginine in blood here reported from the University of Kansas Medical School led to the conclusion that "the substance responsible in the Folin-Wu filtrate of dog blood for most of the color given with the modified Sakaguchi reaction" is probably arginine, "because it is destroyed by arginase (liver extract) and gives a crystalline precipitate with flavianic acid. A method is given by which arginine may be determined directly on the Folin-Wu filtrates of blood."

A micro method for the estimation of cholesterol by oxidation of the digitonide, R. Okey (*Jour. Biol. Chem., 88 (1930), No. 1, pp. 367–379*).—Description is given in this contribution from the University of Rochester School of Medicine and Dentistry of the manipulative detail and special apparatus required for "a micro procedure for the determination of free and total cholesterol by oxidation of the digitonide with silver chromate-sulfuric acid and subsequent titration of the excess dichromate with thiosulfate."

It is further stated that "cholesterol has been shown to be altered by the ordinary saponification procedures in such a way that it is no longer quantitatively precipitated by digitonin. A study of the conditions under which a synthetically prepared ester of cholesterol may be saponified with minimal alteration in the cholesterol has been made, and a special procedure for saponification of blood and tissue extracts which conforms to these conditions has been evolved. Attention is called to the fact that, because of this decomposition of cholesterol during saponification, many estimations of cholesterol by precipitation as digitonide from unsaponifiable matter have given results which did not represent the cholesterol originally present in the material."

The determination of starch in flour by diastase-acid hydrolysis, B. G. Hartmann and F. Hillig (*Jour. Assoc. Off. Agr. Chem., 14 (1931), No. 1, pp. 112–116*).—In the method here contributed from the Food, Drug, and Insecticide Administration, U. S. D. A., "complete gelatinization of starch is assured before diastase hydrolysis is applied." It is noted that "in the Official method 2 hours is required for the starch conversion, whereas 20 minutes is ample time for the conversion procedure proposed.

"The pepsin digestion was introduced because it has been shown by the writers that the application of the enzyme aids in the conversion of the starch content of materials high in proteins, and in the present investigation it has been proved that peptic digestion materially increases the starch yield."

"*The method: Removal of sugars and free fat.*—Accurately weigh 2.5–3.5 gm. of the flour, ground to pass a 40-mesh sieve, into a dry 16-oz. tincture bottle. Add 100 cc. of ether and shake 5 minutes, add 100 cc. of 95 per cent alcohol and shake 5 minutes, and then add 50 cc. of water and shake 5 minutes. Wash the sides of the bottle with 70 per cent alcohol (70 cc. of 95 per cent alcohol made to 100 cc. with water) and centrifuge 10 minutes at about 900 r. p. m. Decant the liquid, and to the residue add 150 cc. of 70 per cent alcohol; shake thoroughly, wash the sides of the bottle with 70 per cent alcohol, and centrifuge. Repeat the centrifuging operation, pour off the liquid, and drain by inverting the bottle several minutes.

"*Conversion of the starch.*—Transfer the residue in the bottle to a 400-cc. beaker with about 150 cc. of water, removing with a curved policeman any starch that may adhere to the sides of the bottle. Now add 7.5 cc. of normal HCl to the contents of the beaker; bring to a boil, stirring constantly; cover with a watch glass; and place on a briskly boiling steam bath for 2 hours. Allow the mixture to cool to about 40° C., add 10 cc. of a 1 per cent pepsin solution, mix thoroughly, and allow to stand overnight at a temperature between 30° and 40°. The next morning add normal NaOH to faint alkalinity

(phenolphthalein) and come back immediately with nromal HCl, adding three drops of the acid in excess. Add 0.2 gm. of calcium carbonate and heat to boiling, stirring constantly. Allow the mixture to cool to 70° and place in a water bath adjusted to a temperature of about 70°. Add 10 cc. of malt extract solution prepared by digesting 20 gm. of ground malt with 200 cc. of water for 2 hours and filtering. (The addition of the 10 cc. of *malt extract solution* will reduce the temperature of the digestion mixture to about 65°.) Maintain this temperature for 10 minutes, stirring the mixture frequently. Now add 10 cc. more of the malt solution and digest an additional 5 minutes. Bring the mixture to boiling and boil 5 minutes, stirring constantly. Cool to 70° and again digest 5 minutes with 10 cc. of the malt solution. Heat to boiling, boil 5 minutes, transfer to a 300-cc. volumetric flask, cool to 20°, make to mark with water, shake, and filter through a folded filter. Transfer 200 cc. of the filtrate to a 500-cc. volumetric flask, add 20 cc. of dilute hydrochloric acid (2+1), and heat in a boiling water bath for 2½ hours. Cool to 20°, make to mark with water, shake, and filter. Transfer 40 cc. of the filtrate to a 400-cc. beaker and neutralize with 10 per cent sodium hydroxide (phenolphthalein). Make slightly acid with normal HCl and adjust to a volume of 50 cc. with water. Determine dextrose by the Munson-Walker method. Run a blank on the malt extract solution in the same manner as in the determination.

"*Calculation.*—$S=\frac{1.6875\ (a-b)}{X}$. S=percentage of starch. a=dextrose in aliquot of sample (mg.). b=dextrose in aliquot of the blank (mg.). X=sample taken (grams)."

Direct determination of available carbon dioxide in baking powder, M. R. Coe (*Jour. Assoc. Off. Agr. Chem., 14 (1931), No. 1, pp. 99–101*).—As an improvement upon the familiar gasometric method requiring two determinations, (1) of the total, and (2) of the residual carbon dioxide, from which the available gas is determined as the difference, the writer proposes the following new method in a contribution from the U. S. D. A. Bureau of Chemistry and Soils. It uses the same apparatus and requires only one determination.

"Run 25 cc. of 5 per cent ammonium sulfate solution into the 250-cc. decomposition flask containing 1.7 gm. of baking powder. Heat the flask and contents at boiling temperature until all gas is evolved and then cool to room temperature. When equilibrium is established, which generally takes about 15 minutes, read the amount of available carbon dioxide on the graduated tube and make the necessary corrections for temperature and pressure.

"Total carbon dioxide also may be determined in a few minutes with the same sample without detaching the flask from the apparatus in the following manner:

"Fill the buret containing a few cubic centimeters of $(NH_4)_2SO_4$ with sulfuric acid (1+5) and run 25 cc. into the flask. Heat the flask almost to boiling, allow to cool as before, and take the reading. Subtract a number corresponding to the number of cubic centimeters of acid used from the number of cubic centimeters found, and make corrections for temperature and pressure. This result gives the total carbon dioxide. *Obtain the result for residual CO_2 by* subtracting the result for available CO_2 from that for the total."

The ammonium sulfate solution used was found preferable to distilled water in that it produced a satisfactory evolution of the carbon dioxide from all varieties of baking powders, was found to act as a protein coagulant for powders containing egg albumin and so served to inhibit foaming, and avoided the low results given by distilled water in the case of powders containing phos-

phates or egg albumin. It is noted, also, that "if the total CO_2 value is desirable, the acid reagent may be used to evolve the residual CO_2 remaining in an ammonium sulfate solution." Full manipulative detail is given.

METEOROLOGY

The weather of 1930 in the United States, A. J. Henry (*U. S. Mo. Weather Rev., 58 (1930), No. 12, p. 496, pls. 2*).—Tables and charts show monthly and annual temperature and precipitation departures for 1930. "The outstanding feature of the weather of 1930 was the great drought and its associated high temperatures during July and August. . . . Precipitation was greater than normal in the peninsula of Florida, in a narrow belt along the immediate Gulf Coast, except from western Louisiana to near the mouth of the Rio Grande, in parts of west Texas and Oklahoma, and over a rather large area in the Great Basin and eastward over Wyoming to western South Dakota; also in southeastern Arizona. Precipitation was below normal elsewhere in the United States. The departures by State boundaries show the following: Maryland without 56 per cent of normal, followed by West Virginia, 59; Virginia, 60; Kentucky, 61; Delaware, 65, and Pennsylvania 68 per cent."

Climatological data for the United States by sections, [November–December, 1930] (*U. S. Dept. Agr., Weather Bur. Climat. Data, 17 (1930), Nos. 11, pp. [201], pls. 3, figs. 3; 12, pp. [202], pls. 3, figs. 2*).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for November and December, 1930.

Monthly Weather Review, [November–December, 1930] (*U. S. Mo. Weather Rev., 58 (1930), Nos. 11, pp. 439–481, pls. 12, figs. 20; 12, pp. 483–513, pls. 14, figs. 5*).—In addition to detailed summaries of meteorological and climatological data and weather conditions for November and December, 1930, solar and aerological observations, and bibliographical information, notes, abstracts, and reviews, these numbers contain the following contributions:

No. 11.—Measurements of Visibility at Danzig (illus.), by H. Koschmieder (pp. 439–444); Meteorological Conditions on the Santiago (Chile)–Buenos Aires (Argentina) Airway, by J. B. Navarrete (pp. 444–446); Recent Warm-Weather Trends as Shown by Graphs of Accumulated Temperature (illus.), by W. A. Mattice (pp. 447–451); The Coöperative Observer, by C. J. Root (pp. 451–453); Are Present Methods in Cooperative Climatological Work Effectual? by J. H. Armington (pp. 453–455); Forest-Tree Diseases Caused by Meteorological Conditions, by E. E. Hubert (pp. 455–459) (see below); and The Rainfall of Salvador (illus.), by A. K. Botts (pp. 459–466).

No. 12.—Weather Recurrences and Weather Cycles (illus.), by R. Gregory (pp. 483–490) (E. S. R., 63, p. 712); Are Meteorological Sequences Fortuitous? (illus.), by C. F. Marvin (pp. 490–493); Aerological Observations Made with a Captive Balloon from a Moving Ship (illus.), by A. Thomson (pp. 494, 495); Meteorology and Seasonal Weather Forecasting: Annual Progress Report of the Scripps Institution of Oceanography, by G. F. McEwen and A. F. Gorton (p. 495); The Weather of 1930 in the United States (illus.), by A. J. Henry (p. 496) (see above); and Preliminary Statement of Tornadoes in the United States during 1930, by H. C. Hunter (p. 497).

Forest-tree diseases caused by meteorological conditions, E. E. Hubert (*U. S. Mo. Weather Rev., 58 (1930), No. 11, pp. 455–459*).—This article discusses some of the diseases caused by physiogenic agencies such as heat, frost, wind, and similar physical causes, including "sunscald, drought, wilting, frost cracks, frost heaving, frost bite, wind breakage, wind throw, wind deformation, red

belt, sun scorch, too much or too little light, lightning injury, ice injury (sleet storms), snow breakage, snow smothering, snow heating, subsnow fungi, root suffocation (too much rain), gas injury, and dust injury." It indicates "the important rôle that meteorological conditions play in causing economic losses in our timber stands. Windthrow, winter injury, and drought injury are alone responsible for a very formidable loss over a period of years."

SOILS—FERTILIZERS

[**Soil Survey Reports, 1926 Series**] (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpts.], Ser. 1926, Nos. 23, pp. 34, pls. 2, fig. 1, map 1; 25, pp. 53, pls. 3, fig. 1, map 1; 26, pp. 31, fig. 1, map 1; 27, pp. 42, fig. 1, map 1; 30, pp. 23, pls. 2, fig. 1, map 1; 31, pp. 50, fig. 1, map 1*).—Reports 23 and 27 were prepared with the cooperation of the Mississippi Geological Survey; No. 25, the Minnesota Experiment Station; Nos. 26 and 30, the Kansas Experiment Station; and No. 31, the University of Nebraska.

No. 23. *Soil survey of Claiborne County, Mississippi*, B. H. Hendrickson and J. E. McKechen.—Claiborne County has an area of 305,280 acres of low plain "immaturely dissected by streams," and is located in the southwestern part of the State. Although drainage in the uplands and much of the terraces is adequate, "in the Mississippi bottoms most of the land is poorly drained and deeply inundated during high flood stages of the river."

Of 19 types assigned to 10 series, Memphis silt loam, 51.4 per cent, is the most extensive, with Grenada silt loam second with 9.5 per cent, the miscellaneous material including 0.9 per cent of river wash, unclassified.

No. 25. *Soil survey of Wadena County, Minnesota*, J. A. Elwell et al.—Wadena County occupies a land area of 342,400 acres and lies a little northwest of the center of the State. "About one-third of the county consists of gently rolling or undulating uplands, composed of glacial till deposits," the remainder of the area consisting of nearly level to undulating plains. With respect to drainage, "the lands of the county lie entirely in the watershed of Crow Wing River. . . . The level plain surfaces, aside from the depressions, are well drained because of the porosity of the substrata. The slopes effectively drain the gently rolling ridge lands."

In order of areal extent, Menahga loamy sand, Badoura peat, Rockwood loam, and Wadena sandy loam, 16.3, 13.5, 11.7, and 11.1 per cent, respectively, lead a list of 30 classified types of 17 series. Alluvial soils, 2.6 per cent, not differentiated in the present report, and muck, 1.5 per cent, constitute the small aggregate area of unclassified material.

No. 26. *Soil survey of Clay County, Kansas*, J. Thorp et al.—Clay County includes 417,280 acres of well-drained lands, in part a dissected plain, in part a "slightly hilly" plain, in the northeastern part of the State.

Idana silt loam, with 37.1 per cent of the total area surveyed, and Lancaster silt loam with 10.7 per cent, were found to be the most extensive among 19 types of 13 soil series here mapped and classified. Less important areas of meadow (4.6 per cent), rough stony land (8.2 per cent), dune sand, and river wash, unclassified, are also listed.

No. 27. *Soil survey of Rankin County, Mississippi*, R. Wildermuth et al.—Rankin County is a land area of 512,640 acres, "a low plain dissected by shallow valleys," in south-central Mississippi. Although "along Pearl River there are well-drained, high, wide benches or stream terraces," it was also found that "bottoms of many streams, such as Richland, Steen, Dobbs, Campbells, Purvis,

and Pelahatchee Creeks, with some of their tributaries, are either too poorly drained in many places or are subject to overflow at too frequent intervals during the growing season to be suitable for agriculture."

Of 38 types representing 24 series, Grenada silt loam, of which the "drainage could be improved by ditching or tiling," underdrainage being poor, is the most important area, 16.7 per cent, followed by 13.1 per cent of Lexington very fine sandy loam and 10.7 per cent of Pheba silt loam, of which it is stated that "its poor drainage and low average fertility have caused it to be avoided for cultivated crops."

No. 30. *Soil survey of Labette County, Kansas*, E. W. Knobel et al.—Labette County comprises an area of 416,000 acres lying in the southeastern part of the State. In general the surface features are those of an undulating to gently rolling prairie. Though the underdrainage is said not to be at all points satisfactory the general surface drainage provided by the Neosho and Verdigris Rivers and their tributaries was found good.

The soils examined are here classified as 11 series, inclusive of 20 types, of which Parsons silt loam leads in areal extent with 30.0 per cent of the area, while Labette silt loam follows with 19.9 per cent.

No. 31. *Soil survey of Franklin County, Nebraska*, F. A. Hayes et al.—Franklin County possesses 367,360 acres of lands of the loess region, mostly the loess hills section, the remainder being included in the loess plains. Drainage is provided by the Republican River and numerous tributaries.

The soils of Franklin County consist of 17 series, inclusive of 27 types. Holdrege silt loam which, in common with the soils of the Hastings and Crete series, is described as "very productive," occupies 38.1 per cent of the entire area of the county and is followed by 20.5 per cent of Colby silt loam. Minor areas of dune sand, rough stony land, and river wash constitute the unclassified material.

Soil Survey of Iowa.—Reports 60–65, W. H. Stevenson, P. E. Brown, et al. (*Iowa Sta. Soil Survey Rpts. 60 (1930), pp. 64, pl. 1, figs. 8; 61 pp. 64, pl. 1, figs. 8; 62, pp. 72, pl. 1, figs. 15; 63, pp. 72, pl. 1, figs. 8; 64, pp. 64, pls. 2, figs. 8; 65, pp. 72, pls. 2, figs. 6*).—The six surveys here noted form a part of the previous series (E. S. R., 62, p. 19), and deal respectively with Carroll, Howard, Warren, Chickasaw, Kossuth, and Clayton Counties. In each case field and greenhouse fertility experiments occupy a considerable part of the report. The data supplement the Federal soil surveys previously noted (E. S. R., 62, pp. 19, 714, 715, 716; 63, p. 115).

Preparation of soil profiles for exhibition and soil study, R. C. Collision and J. D. Harlan (*New York State Sta. Tech. Bul. 173 (1930), pp. 8, figs. 2*).—"Two methods of preparation are described, one for making square or rectangular cross sections of soils of any size desired, and the other for preparing cylindrical profiles and surrounding them with transparent celluloid. Their length can be of any value desired, or on the other hand any particular horizon may be prepared. These methods were worked out in this laboratory to meet a demand for soil profiles showing not only the various horizons of certain poorly drained soils, but also for a demonstration of the permeability of such soils to water in their natural field condition."

Both methods were shown to be applicable for the preservation of soil profiles of all types from clay to sand, except in the presence of large stones. For the method producing a column of square cross section, "a fairly moist soil works best although even in rather dry soils the method has worked well." For the preparation of the celluloid-covered cylinders, the soil "should be

higher in moisture than is necessary for taking open profiles. It should not be near saturation, however, or in clay soils some of the fine detail shown on the surface of the profile will be smeared with clay."

Character of the colloidal materials in the profiles of certain major soil groups, M. S. Anderson and H. G. Byers (*U. S. Dept. Agr., Tech. Bul. 228 (1931), pp. 24*).—The soils studied consisted of two typical podsol profiles, those of a Beckett loam from a virgin forest area in Massachusetts, and of a Superior fine sandy loam "from a wood lot of virgin soil," Wisconsin; one pedocal soil, Potter County, Tex.; and an aluminous laterite from Arkansas, a ferruginous laterite from the neighborhood of Preston, Cuba, and from North Carolina, "a Davidson clay loam soil, lateritic in character."

Of the experimental work and its results it is stated that "the chemical composition of each of the colloids and the various properties which serve to characterize these materials were studied. These properties include heat of wetting, adsorption of water vapor over 30 per cent sulfuric acid and over 3.3 per cent sulfuric acid, moisture equivalent, content of exchangeable monovalent and divalent bases, and base-exchange capacity.

"On the basis of the data presented the calcification process leads to uniformity of colloidal material so far as major chemical constituents are concerned. The ratio of silica to sesquioxides is relatively high, as are also most of the property values. Colloidal calcium carbonate is present in the lower horizons and this material appears to possess relatively low property values. The podsolization process leads to the formation of profiles containing colloidal materials of widely varying character in the different horizons. Silica-sesquioxide ratios of the A_0 and A_1 horizons are high, those of the B horizons are relatively low, and those of the C somewhat higher than those of the B. Property values of the A_1 and B colloids are anomalous, those of the A_1 being much lower and those of the B horizon colloids much higher than usually accompany such silica-sesquioxide ratios. Organic matter is shown to play an important part in the properties of these colloids. The lateritization process leads to the development of colloids whose ratio of silica to sesquioxides is low and whose property values are low. The kaolinized horizon has low property values comparable to those of mineral powders rather than to ordinary soil material.

"The hydrogen-ion concentration of electrodialyzed colloids varies widely. These variations show no close relationship to chemical composition. However, there is some tendency toward a direct relationship between hydrogen-ion and silica-sesquioxide ratio, the pH values of the laterites being much higher than those of colloids with high silica-sesquioxide ratio. Long standing of the colloids after electrodialysis brought about an increase in pH values, suggesting that a part of the nonexchangeable bases of the colloid particles may have become exchangeable, thus replacing some of the hydrogen ions in the surface layers."

Variations of the colloidal material extracted from the soils of the Miami, Chester, and Cecil series, R. S. Holmes and G. Edgington (*U. S. Dept. Agr., Tech. Bul. 229 (1930), pp. 24, fig. 1*).—Chemical analyses of the colloids from several samples of soils of the Chester, Miami, and Cecil series are here reported, together with data on the base-exchange capacity and water-vapor adsorption of the fractions examined. Further, "a description is given of each soil profile, its location, hydrogen-ion concentration, and colloidal content. The variations within the profile characteristic of the soil series are pointed out. The relative constancy in composition of the colloids of each series is calculated and discussed. A comparison is made between the colloids from the different soil series. The character of the colloidal material from a soil profile not typical of its series is compared with the mean of that series."

The essential conclusion drawn is that "the colloids of the various profiles of a soil series are remarkably similar in character and are essentially different from those of even closely related series."

A laboratory study of the field percolation rates of soils, C. S. SLATER and H. G. BYERS (*U. S. Dept. Agr., Tech. Bul. 232 (1931), pp. 24, figs. 4*).—A soil-core auger that will satisfactorily cut cores of undisturbed soil, is simple in design, and is easily constructed is here described, together with a procedure for the evaluation of the percolation rates of soil cores. Also, "a procedure has been standardized for the measurement of the percolation rates of laboratory-packed samples of soil. The causes of the variation in percolation rate between laboratory-packed samples and field cores of the same soil were studied.

"The order of permeability for six surface soils has been established. The percentages of silt these soils contain, the suspension percentage, and the percolation ratio have been found to represent the same order. The suspension percentage and the percolation ratio are valuable criteria of relative field permeability.

"The field-percolation rate of a soil is governed more by the water passageways it contains (root channels or structural cleavage) than it is by the character or volume of the pore space of the soil mass. The percolation rates of cores serve as a means of studying field permeability, but these rates vary too widely for cores of the same soil to attempt to fix field-percolation rates by this means alone, unless large numbers of cores are obtained. The ratios for erosion and for the permeability of soils show that these properties are inversely proportional in terms of the factors of the percolation ratio."

Experiences with the Neubauer method for determining mineral nutrient deficiencies in soils, S. F. THORNTON (*Jour. Amer. Soc. Agron., 23 (1931), No. 3, pp. 195–208, figs. 3*).—A detailed discussion of the Neubauer method (E. S. R., 50, p. 118; 53, p. 319) is submitted from the Indiana Experiment Station. The comparative results of experiments involving six soil series, and taking up the 0.2 N nitric acid extraction, Neubauer method, Illinois phosphate test, Hoffer stalk test, pot tests, and field yields, are shown.

"With certain soils, especially where single severe deficiencies exist, all methods give correct indications as to the available nutrient supply of the soil; but in numerous instances the correlation between the different methods is very poor. Generally, the results of the Neubauer method are found in closest agreement with results of pot tests and with results of field tests when proper consideration is given to other possible limiting factors. Especially apparent with the 0.2 N nitric acid extraction and the Illinois phosphate tests are the extremely high phosphate results for all soils having received applications of phosphate rock and for soils of the Culver sand series regardless of previous fertilization. As tentative limit values for deficiencies with the Neubauer method as applied to average field crops under Indiana farming conditions, 4 mg. phosphoric anhydride and 10 mg. potassium oxide are suggested. Of the factors affecting nutrient absorption by the seedlings, light intensity, moisture content, soil reaction, and the presence of other nutrients are of minor importance; but both selection of seed and temperature control require the utmost attention."

Phosphate deficiency in the soils of Montana.—A preliminary report, I. J. NYGARD (*Montana Sta. Bul. 240 (1931), pp. 32, figs. 16*).—"The numerous field experiments in the irrigated sections show that many soils of the State are distinctly phosphate deficient toward such important crops as alfalfa, sugar beets, and spring wheat."

Phosphate trials on 42 alfalfa fields in widely scattered irrigated valleys show an increase in yield exceeding 100 per cent in some cases, the average increase per cutting of all fields being 18 per cent, or 0.2 ton, per cutting. In certain cases field experiments showed the residual effect of 200 lbs. per acre of treble superphosphate in the third year.

"Phosphate deficiency in cattle feeds was found on farms and ranches where the soils were deficient in phosphates. An application of available phosphate, such as treble superphosphate, distinctly increased the phosphoric acid content of alfalfa grown on phosphate-deficient soils. . . . In eight sugar beet fields of the 20 used for experimental purposes, increases in yield from more than 100 to 416 per cent were found. . . . Yields of spring wheat on irrigated land were increased by the use of phosphate fertilizers. Yields of potatoes were increased by the use of phosphate fertilizers."

Tests were made also of the available phosphate in a number of soil samples from regions of dry-land farming. The results suggested that phosphate deficiency is not confined to the heavily cropped soils of the irrigated valleys of the State.

A study on the influence of climate upon the nitrogen and organic matter content of the soil, H. Jenny (*Missouri Sta. Research Bul. 152 (1930), pp. 66, figs. 25*).—"After suitable climatic maps of the United States had been constructed and a large number of nitrogen analyses correlated with temperature and moisture, it was found that climate exerts a dominating influence on the amount of total nitrogen in soils. With increasing temperature soil nitrogen and organic matter decrease, while with increasing moisture values they increase. It is possible to construct an idealized nitrogen-climate-surface for the soils of the Great Plains area and the prairie region. A causal relationship between the nitrogen-temperature relation on the one hand, and soil organic matter maintenance and low corn yields in southern regions on the other, has been suggested."

Three earlier papers developing the mathematical relation of soil nitrogen and organic matter to climatic factors have been noted (E. S. R., 60, p. 118; 61, p. 316; 63, p. 419). A list of 88 citations to the literature is included.

Nitrate assimilation in soils, F. B. Smith and P. E. Brown (*Iowa Sta. Research Bul. 135 (1931), pp. 33–63*).—The three parts of the experimental work here reported dealt respectively with the nitrate-assimilating power of the soil, the effect of soil treatment on this capacity, and the assimilation of nitrates by soil microorganisms. A list of 76 titles of cited literature is appended.

In part, "it was found that dextrose increased the nitrate-assimilating power of the soil. This material furnished a source of energy for those organisms which utilized both nitrate and ammonia, thus preventing an accumulation of nitrate. . . . Straw, partially decomposed straw, and farm manure brought about an assimilation of nitrate immediately upon being added to the soil. The straw brought about a larger assimilation of nitrate than the straw manure or the farm manure. Manure, lime, and rock phosphate applied over a period of years on Marshall silt loam and Grundy silt loam tended, in general, to lower the nitrate-assimilating power of the soil. The nitrate-assimilating power of Carrington loam treated in the field with different manures varied throughout the season, showing only slight differences between the different treatments. Very similar results were secured with manure, lime, and crop residues on both continuous corn and corn in the three-year rotation.

"Five cultures of nitrate-assimilating and nine cultures of denitrifying bacteria were isolated and studied in pure culture. . . . A number of nitrate-

assimilating and denitrifying tests were carried out with some of the organisms in pure culture. Nitrate assimilation is common to a large number of soil microorganisms. It has been suggested, however, that the molds are largely responsible for nitrate assimilation when the energy supply of the soil is increased. The results obtained in these experiments indicate that certain molds may be less efficient nitrate assimilators than some bacteria."

Influence of various non-nitrogenous compounds on the growth of certain bacteria in soils of low productivity, H. J. Conn and M. A. Darrow (*New York State Sta. Tech. Bul. 172 (1930), pp. 40*).—Three strains of non-spore-forming bacteria, abundant in other soils near the station, but apparently not occurring normally in the two soils, Volusia silt loam and Hoosick coarse sandy loam, neither of which is highly productive, although seeming on analysis to contain an abundance of phosphorus, potassium, and especially nitrogen, were selected as test organisms. One of these strains was *Bacterium globiforme* Conn (E. S. R., 60, p. 420). "The object of the study was to see what treatment could be given the soils in order to secure growth of these bacteria. The bacteria selected were considered to have nitrogen requirements very similar to those of green plants; and it was believed that the results obtained would therefore give some indication why the nitrogen in these soils is not available to plants.

"The tests were made by adding various ingredients to the soils, sterilizing, and inoculating with the bacteria. After incubation, the ability of the bacteria to grow was determined by microscopic examination. The results indicate that these soils lack available nitrogen for these bacteria, just as they are known to do for plants, in spite of the fact that both soils are higher in total nitrogen than two of the Dunkirk series in which the tests organisms can grow readily without added nitrogenous matter. Growth of the bacteria can be secured in either of the two soils under investigation by adding ammonium salts, nitrates, or certain forms of organic nitrogen. Growth can also be secured by adding other simple compounds that do not contain nitrogen, such as hydroxides, sulfates, carbonates, and phosphates of the strong alkali metals. This effect is much more pronounced in the Volusia soil than in the Hoosick soil.

"It is believed that the action of these latter compounds is due to their making the nitrogen in the soil available to the bacteria under investigation. This nitrogen may possibly be unavailable in the untreated soil because of being adsorbed by the soil colloids—a possibility suggested by the high ratio of colloids to calcium in both soils. It is possible that the same theory will explain the lack of availability of this nitrogen to green plants. Experiments are under way to discover whether a similar treatment of such soils will increase nitrogen availability to plants."

A soil management program for Carrington loam, W. H. Stevenson, P. E. Brown, et al. (*Iowa Sta. Bul. 276 (1931), p. 65–84, figs. 2*).—Of the detailed findings with respect to the most profitable management of Carrington loam, as indicated by tests on 12 cooperative soil experiment fields, the following are illustrative:

"The use of a good rotation of crops, including a legume, is essential for the results. . . . The application of farm manure is distinctly profitable on this soil, and the yields of general farm crops are increased considerably by it. Crop residues also have beneficial effects on the soil, especially when the legume residues are turned under. . . . The soil is acid in reaction, and lime must be added for the best growth of legume crops. Grain crops are often greatly benefited also. . . .

"The application of a phosphate fertilizer is very desirable on this soil. The yields of general farm crops have been increased following the use of either rock phosphate or superphosphate. In some cases the latter seems to give better results, but often rock phosphate has proven quite as desirable. *Superphosphate may usually be expected to give quicker results.* Rock phosphate, on the other hand, usually gives greater effects the second year after application. . . . It is believed that in general neither potassium nor nitrogen fertilizers should be employed on this soil, except in addition to a phosphate. Tests of these materials should therefore be made with a basic treatment of a phosphate."

Results of fertilizer experiments on Norfolk fine sandy loam and on Norfolk sandy loam, J. J. SKINNER (*U. S. Dept. Agr., Tech. Bul. 225 (1931), pp. 23, figs. 10*).—In cooperation with the South Carolina Experiment Station, results are reported of a 10-year fertilizer experiment with cotton and corn grown in rotation on Norfolk fine sandy loam at the Pee Dee Substation, and of a 3-year experiment with cotton on Norfolk sandy loam in Darlington County, S. C. The experiments were based on the triangle diagram, using nitrogen, phosphoric acid, and potash, singly, in combinations of two, and in combinations of three, the ratios varying in definite proportions. The various combinations contained in each case 15 per cent of total plant food and were applied 900 lbs. to the acre for the cotton and 450 lbs. to the acre for the corn.

For the Norfolk fine sandy loam "the average results indicate a 5–8–2 analysis as being best for cotton." On the Norfolk sandy loam tested, "the largest cotton yields were secured with fertilizer mixtures containing 6 to 9 per cent ammonia, 6 to 9 per cent phosphoric acid, and 0 to 3 per cent potash. . . . *Considering the data as a whole, a mixture for this soil should contain* 6 to 7 per cent amonia, 6 to 8 per cent phosphoric acid, and 1 to 3 per cent potash."

Inspection of commercial fertilizers for the season of 1930, H. D. HASKINS (*Massachusetts Sta. Control Ser. Bul. 54 (1930), pp. 64, figs. 5*).—In addition to the usual analyses and related information, this bulletin reports three vegetation pot experiments.

Vegetation pot experiment to study nitrogen availability.—Continuing previous work (E. S. R., 63, p. 121), each pot received 38 lbs. of soil mixture made up of 2 parts sifted sand, 1 part of loam taken from land treated neither with manures nor with other nitrogenous fertilizer since 1890, 24.4 gm. of fine ground limestone, 16.33 gm. of muriate of potash, 15 gm. of potash-magnesium sulfate, 8.2 gm. of high-grade sulfate of potash, 25 gm. each of 16 per cent superphosphate and basic slag phosphate, and nitrogen from the 22 materials compared to supply 0.42 gm. per pot. Two series were run (1) with the nitrogenous materials in statu, and (2) of the same altered by washing to remove water-soluble nitrogen. The results are tabulated, red dried blood being taken as a comparison standard at 80, and the comparative nitrogen activity being determined by the alkaline permanganate and neutral permanganate methods. The growth obtained in each series and with each source of nitrogen is also shown by photographs. The materials compared included dark dried blood, cottonseed meal, tankage, garbage tankage, fleshings from hides, linseed meal, Peruvian guano, rapeseed meal, rubberseed meal, and whale guano.

The effect of manganese sulfate on yield of dry matter and recovery of nitrogen.—Neither dry matter yields nor nitrogen recovery indicated any need for the addition of manganese to the soils used.

Vegetation pot experiment with phosphates.—The products indicated in the following list were compared: Ammoniated superphosphate, Ammo-Phos, a basic slag phosphate, calcined phosphate (a product not yet commercially made), a "colloidal" phosphate, a "fused phosphate and potash," a residue described as largely iron and aluminum phosphates, Ober residue, prepared by the U. S. D. A. Bureau of Chemistry and Soils "from the so-called insoluble phosphoric acid found in ammoniated superphosphates, precipitated bone, precipitated phosphate, Reform phosphate, finely ground rock phosphate, superphosphate, and triple superphosphate. Three series, "minimum phosphoric acid," "optimum phosphoric acid," and "double optimum phosphoric acid," were carried out with these materials, the test crop being dwarf Essex rape. Photographs show the growth obtained and availability data are tabulated, the basis of comparison being superphosphate, taken as 100. In most instances the availability based upon phosphoric acid recovery was higher than that based on yield of dry matter.

The nitrification of ammonium sulfate as influenced by soil reaction and degree of base saturation, J. A. NAFTEL (*Jour. Amer. Soc. Agron., 23 (1931), No. 3, pp. 175–185, figs. 5*).—Nitrification of ammonium sulfate was studied, using five soils that differed widely in percentage base and calcium saturation at similar pH values, in the work reported in this communication from the Alabama Experiment Station. "After 10 days' incubation, nitrification of ammonium sulfate occurred at pH 4.1 only in the soil which had a high percentage base and calcium saturation. In soils having a lower base saturation, nitrification of ammonium sulfate did not occur at this reaction during the same period. Nitrification varied considerably in different soils at similar reactions. Differences other than base saturation and reaction appear to be very important in the process of nitrification at low reactions. . . . Nitrification increased with the percentage base and calcium saturation."

Inspection of agricultural lime products for the season of 1930, H. D. HASKINS and H. R. DEROSE (*Massachusetts Sta. Control Ser. Bul. 57 (1930), pp. 6*).—This nineteenth report on the inspection of agricultural lime products in Massachusetts gives "the composition of the various products which have been sold, supplemented by comparative costs of units of effective oxides present. The tonnage of lime products sold as soil amendments is given, with similar data for a previous year."

Analyses of commercial fertilizers, fertilizer supplies, and home mixtures for 1930, C. S. CATHCART (*New Jersey Stas. Bul. 514 (1930), pp. 39*).—"This bulletin contains a portion of the results obtained during the inspection of fertilizers sold during the year 1930."

Analyses of commercial fertilizers and ground bone; analyses of agricultural lime, 1930, C. S. CATHCART (*New Jersey Stas. Bul. 517 (1931), pp. 29*).—This is the report for the second part of the 1930 inspection, supplementing Bulletin 514, above noted, and briefly discussing the results for the year.

Fertilizer registrations for 1931, C. S. CATHCART (*New Jersey Stas. Bul. 518 (1931), pp. 22*).—The brands registered, with their guarantees, are listed.

AGRICULTURAL BOTANY

Botany: A textbook for college and university students, W. J. ROBBINS and H. W. RICKETT (*New York: D. Van Nostrand Co., 1929, pp. XXIII+535, pl. 1, figs. 384*).—It is stated that in this book, said to be the outgrowth of the course in general botany as offered at the University of Missouri, the attempt

has been made to present the fundamental biological principles rather than to lay the foundation for professional botany, to illustrate the aim of science and the scientific method, and to indicate the variety and extent of the living world so far as comprehended in the plant kingdom.

Elements of general botany, H. D. Barker (*Éléments de Botanique Générale. Port au Prince, Haiti: Serv. Tech., Dept. Agr. et Enseig. Prof., 1928, pp. XV+323, pl. 1, figs. 154*).—This book, intended to serve as a manual of botany to students, is said to present results of several years of close study of the plants of Haiti and of experience in botany teaching in the Central School.

Chemical treatments for shortening the rest period of plants, F. E. Denny (*Jour. Soc. Chem. Indus., Trans., 47 (1928), No. 34, pp. 239T–243T, figs. 4*).—As the result of experimentation in which tests were made with about 250 chemicals over a range for each of concentrations and time periods on potato tubers, woody shrubs, and bulbs, no doubt was left as to the effectiveness of chemical treatments in shortening rest periods and thus forcing early growth of dormant buds, though much more work, it is admitted, needs to be done in applying the treatments to the special conditions met with in practice. Some treatments are discussed as not prohibitively expensive or unsafe. A desirable uniformity of results is indicated as conducive to progress in such studies. More effective chemicals are desirable.

Influencing germination [trans. title], A. Niethammer (*Zellstimulationsforsch., 3 (1929), No. 3, pp. 201–244*).—This is a study of the basis and practical aims of influencing the course of germination in seeds of agricultural plants by chemical and physical agencies, the results of which work are presented in tabular and discussional detail.

Studies of germination of seeds.—Part I, Transformation of nitrogenous compounds during germination of soya-bean seeds, S. Sasaki (*Bul. Agr. Chem. Soc. Japan, 4 (1928), No. 4–6, pp. 75–77*).—This paper is in two parts, the first dealing with method of germination and the second with analyses of nitrogenous compounds in seeds and seedlings. The chemical data are detailed.

Plant water relations, B. E. Livingston (*Quart. Rev. Biol., 2 (1927), No. 4, pp. 494–515*).—In this account dealing with water in plants, the causation of its movement into and in the plant in relation with gravity and other influences receive detailed attention. This movement is followed from the stages preceding germination through the seedling development and subsequent stages, with somewhat particular consideration of water entrance via the roots, water utilization and water loss, traction force in liquid water, pressures in the plant, and certain other magnitudes and rate relations.

The statement is made that "what now seems to be the basic clue to the mechanics of the rise of water in trees did not get adequately presented until the appearance of Dixon's publication in 1909" (E. S. R., 21, p. 318; 27, p. 222; 56, p. 424). Significant contributions on the subject are listed.

A study of the relations between chloroplast pigments and dry weights of tops in dent corn, H. B. Sprague and J. W. Shive (*Plant Physiol., 4 (1929), No. 2, pp. 165–192*).—Three series of experiments on *Zea mays* attempted to determine the amounts of chlorophyll pigment present in certain leaves at periodic intervals, also in leaf areas and in plant tops. Data are tabulated for the conditions, with discussion.

Increase rate of leaf area and of dry weight of tops both normally declined with age, but they were not always in close correlation. The smallest varietal leaf area also went with lowest top dry weight. Chloroplast pigment measurements showed no close relation to the growth rates in a given strain. High chlorophyll and carotene accompanied high increase in top dry weight. Xan-

thophyll showed no constancy or definite relation to growth rate. Chlorophyll in contrast to carotene and xanthophyll was more closely correlated with leaf areas than with leaf dry weight.

Leaf area unit dry weight increased at successive harvests for all strains of corn. Close correlation appeared between total chlorophyll and top dry weight at successive harvests. Less close were the correlations between total carotene and dry weight and between total xanthophyll and dry weight. In series two the average ratios between total chlorophyll and top dry weight were practically identical for all three strains of corn used. Ratios between dry weight and xanthophyll were variable and their significance doubtful.

Hemicellulose as a storage carbohydrate in woody plants, with special reference to the apple, A. E. Murneek (*Plant Physiol., 4 (1929), No. 2, pp. 251–264, figs. 5*).—In advancement of aims previously indicated (E. S. R., 60, p. 232; 61, p. 40), this paper briefly reviews present knowledge regarding the occurrence, distribution, and chemistry of hemicelluloses in some higher plants in which this group frequently represents a very large portion of the carbon and carbohydrates.

The effect of potassium, nitrogen, and phosphorus fertilizing upon the chloroplast pigments, upon the mineral content of the leaves, and upon production in crop plants, F. M. Schertz (*Plant Physiol., 4 (1929), No. 2, pp. 269–279*).—In an earlier paper (E. S. R., 48, p. 525) the effect of nitrogen on the chloroplast pigments was indicated. Nitrogen is supposed to influence more than any other element the growth of plants. The methods used in the present work for extracting and separating the pigments were the same as those previously described (E. S. R., 62, p. 616), that of measuring the chlorophyll present being identical with those previously outlined (E. S. R., 63, p. 23). The results are presented in tabular detail. Only fresh leaves should be used in the determination of the four chloroplast pigments. Much of the carotene and xanthophyll is lost in drying, this process being much more destructive to the carotenoids than it is to the chlorophylls.

Phosphorus, potash, and nitrogen may be severally correlated with an effect on the formation of chloroplast pigments. Nitrogen was correlated with increase of chloroplast in fresh green leaves, as also with an increase in carotenoids. In potatoes and cotton high potash evidently suppressed chloroplast pigment formation. High phosphorus plats would, then, evidently produce more chloroplast pigments than potash and less than nitrogen. Either cotton or potato plants fertilized with high nitrogen always gives a high nitrogen leaf content. Plats high in potash gave low yields of cotton, while those high in nitrogen produced the most cotton per acre, though this was not true for all types of soil. The results given in this paper are said to harmonize with those of Maiwald (E. S. R., 52, p. 123) for potatoes.

Nitrogen, phosphoric acid, and potash starvation at different stages of the growth of Fragaria, M. B. Davis and H. Hill (*Canada Dept. Agr. Pamphlet 96, n. ser. (1928), pp. 8, pls. 3*).—From series of strawberry plants grown in pure sand and deprived during different periods of nitrogen, phosphorus, and potash, information as regards the symptoms which is regarded as of value in the diagnosis of nutrition was obtained.

As regards influence on the set, nitrogen is equaled or exceeded by phosphorus. In plants starved during fruit bud formation as regards either of these two elements, very early spring correction of the deficiency results in increased flower production. Whether this increase is due to the formation of new buds or to the development of buds formed in the fall (which would not otherwise develop) is not known.

Hormone action of elements of the rare earths upon neoformations in roots [trans. title], M. ARENA (*Bul. Orto Bot. R. Univ. Napoli, 9 (1928), No. 1, pp. 1–16*).—Examination and comparison of results as tabulated from studies are said to show a stimulating influence exerted by certain compounds of rare earths in determining by short exposures the formation of adventive roots in *Alternanthera spathulata*. The results are particularized.

Radiosensitivity of Vicia faba, [I], II [trans. title], V. RIVERA (*Riv. Biol., 8 (1926), No. 4–5, pp. 505–539, figs. 2; 10 (1928), No. 1–2, pp. 155–185, figs. 5*).—Previous related contributions have been noted (E. S. R., 58, p. 422; 62, p. 122). Radiosensitivity among plants, as manifested by differences in growth after irradiation, is widespread, though more or less specific as regards manifestations. It is thought that a relation may hold between radiosensitivity and heliosensitivity. *V. faba*, which shows marked heliosensitivity, presents also extraordinary sensitivity to Röntgen rays. Other legumes much less sensitive to light show greatly reduced sensitivity to the X-rays. Details are given.

In the second article, details and tabulations are presented as to the procedure and results when *V. faba* was exposed to a relatively strong dosage of gamma rays.

Studies in pollen quality of fruit trees [trans. title], E. JOHANSSON (*Meddel. Perm. Kom. Fruktodlingsförsök [Sweden], No. 16 (1929), pp. 14; Eng. abs., pp. 13, 14*).—A report in discussional and tabular detail is made on results of experiments at Alnarp, carried out in the same way as those previously reported (E. S. R., 57, p. 140), on the capability of fruit-tree pollens of many varieties to develop tubes in sugar solution.

Injury to fruit trees from cold [trans. title], D. SCARAMUZZI (*Italia Agr., 66 (1929), No. 5, pp. 263–277, figs. 23*).—Contributory, critical, and contradictory factors and conditions are discussed with tabulations.

GENETICS

Genetic growth differentiation in guinea pigs, H. C. MCPHEE and O. N. EATON (*U. S. Dept. Agr., Tech. Bul. 222 (1931), pp. 36, figs. 12*).—Family differences in the weights at different ages from birth to two years of age were observed by the Animal Husbandry Division in five inbred families of guinea pigs. The rates of growth from birth to maturity differed among the families, and were affected by size of litter. Considerable differences were also shown in the ages at which different percentages of the mature weights were reached, but in general it was found that the families having the greater mature weights required longer to reach a given percentage of this weight. Considering the mature weight the control stock was heaviest, followed in order by two families which were designated as the heavy group and three families forming the lighter weight group. Crosses between the lightweight families resulted in a marked increase in the growth and weight of the offspring. The young produced by crossing heavyweight and lightweight families had a growth curve approaching that of the heavyweight family, but crosses between heavyweight families did not result in a significant stimulation in growth up to one year. The influence of crossing appeared to persist into the second generation, although there was no clear indication of segregation of the genetic factors controlling weight. The family from which the dam came also played an important part in determining the weight character of the offspring in crosses of heavyweight and lightweight families. Individuals produced by dams from heavy families were considerably heavier even at two years of age than those produced by dams from the light families in these crosses.

Variations in weight were reduced to 40 per cent in the homozygous inbred lines as compared with the control stock. The genetic factors affecting growth appeared to be independent of the factors affecting fertility, mortality, and monstrosities, but the means of fixing these characters was by close breeding and selection under optimum environmental conditions.

The association of comb and crest characters in the domestic fowl, M. A. JULL (*Jour. Heredity, 21 (1930), No. 1, pp. 21–28, figs. 2*).—In a study in the U. S. D. A. Bureau of Animal Industry of the association between the character of the comb and crest in the domestic fowl, the character and frequency of the different types of offspring produced by a spiked rose comb noncrested male when mated to single and rose comb and crested and noncrested hens is described. This study showed an association of the multiple point rose comb with the crest character. From the evidence it is concluded that the multiple point character of the rose comb was due to another mode of expression of the crested gene.

It was also observed that in crested birds having single combs the single combs are frequently lopped.

The linkage between the genes for rose comb and crest previously reported by L. C. Dunn and Jull[2] is considered to be doubtful.

Biological essays on horse breeding and horse breeds, C. WRIEDT (*Biologische Essays über Pferdezucht und Pferderassen. Berlin: Paul Parey, 1929, pp. 172, figs. 94*).—In addition to giving accounts of several breeds of horses, the inheritance of color, lethals, twinning, size, etc., in horses is described.

Breeding by artificial insemination, E. J. IVANOFF (*Imp. Bur. Anim. Genet. [Edinb. Univ.], Quart. Bul. 2 (1930), pp. 2–5*).—An account is given of the extent to which artificial insemination is being employed in Russia in breeding operations with horses, cattle, swine, and sheep. The results are deemed as satisfactory as with natural breeding, and the transmission of disease is largely controlled.

Artificial insemination with motile sperm from ovariotomized fowl, L. V. DOMM (*Soc. Expt. Biol. and Med. Proc., 28 (1930), No. 3, pp. 316–318*).—As a continuous passage between the spermatic tubules in the right testis-like gonad of poulards and the vas deferens could not be demonstrated, a suspension of the sperm from a gonad containing spermatozoa was employed in attempts to fertilize females artificially. The results, however, were negative.

Biochemical studies of human semen.—II, The action of semen on the human uterus, R. KURZROK and C. C. LIEB (*Soc. Expt. Biol. and Med. Proc., 28 (1930), No. 3, pp. 268–272, figs. 3*).—In continuing this series (E. S. R., 57, p. 724) it was found that strips of human uteri suspended in warm Ringer's solution reacted differently to the addition of 1 cc. of warm semen.

Semen samples also differed regarding their stimulating and depressing properties on the uterus. It was further found that the same semen may stimulate one uterus and relax another.

These studies suggest causes of sterility in humans.

On the almost instantaneous transport of spermatozoa through the cervix and the uterus in the rat, C. G. HARTMAN and J. BALL (*Soc. Expt. Biol. and Med. Proc., 28 (1930), No. 3, pp. 312–314*).—The results of several experiments are cited to show that the spermatozoa of the rat are transported very quickly (about one-half minute) following copulation up to the tubal end of the uterus.

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[2] Jour. Genetics, 19 (1927), No. 1, pp. 27–63.

Implantation of juvenile testicular tissue into the hypertrophied right gonad of ovariotomized fowl, L. V. DOMM (*Soc. Expt. Biol. and Med. Proc., 28 (1930), No. 3, pp. 314–316*).—Juvenile testicular tissue was implanted in the right testis-like gonad of 16 poulards. Although the behavior of these birds was essentially masculine, none were known to tread. Histological examination revealed five cases of spermatogenesis. In the others there was considerable variation in the development of the germinal tissue in the grafts.

The plumage and oviduct response to the female hormone in fowls, M. JUHN, F. E. D'AMOUR, and R. G. GUSTAVSON (*Endocrinology, 14 (1930), No. 5, pp. 349–354, figs. 8*).—This is essentially a repetition of the experiments previously noted (E. S. R., 63, p. 128), except that extracts of human pregnancy urine, cow placenta, and the untreated urine from pregnant humans were used as the sources of the female hormone. These substances caused hypertrophy in the oviduct of pullets and the development of the female type of feathers on capons. Failure to inject the birds with the hormone one day a week caused the production of a black bar (a male characteristic) in the breast feathers.

The effects of simultaneous injections of the female and male hormones in capons, M. JUHN, F. D'AMOUR, and E. B. WOMACK (*Amer. Jour. Physiol., 95 (1930), No. 3, pp. 641–649, figs. 5*).—Male and female sex hormones were injected either separately, mixed just before injection, or mixed for periods up to 48 hours before injection into five Brown Leghorn capons, and the influence on the head furnishings and plumage development following plucking was studied. As the presence of both hormones in the birds stimulated the growth of the combs and wattles as in males and modified the plumage to the female type, it was concluded that there was no antagonism between the two hormones, and further that the manner in which they were mixed did not appear to modify the action of either.

A quantitative study of ovulation in the rabbit, J. M. WOLFE (*Soc. Expt. Biol. and Med. Proc., 28 (1930), No. 3, pp. 318, 319*).—The anterior lobe of the hypophysis of sows was found to vary in its gonad-stimulating power with the stages of the oestrous cycle in the sows from which the gland was removed. When the ovaries of the donor contained inactive corpora lutea and follicles measuring from 6 to 8 mm. in diameter, 1 mg. of the gland was found to induce ovulation in rabbits, but injections of 20 mg. of the gland were required when the ovaries of the donor contained inactive corpora lutea and follicles 10 mm. in diameter. Forty mg. of the anterior lobe were required to give the same results when the ovaries of the donor contained large active corpora lutea and small resting follicles.

Humoral mechanisms concerned in ovulation in the rabbit, M. H. FRIEDMAN (*Endocrinology, 14 (1930), No. 5, pp. 328–336, figs. 7*).—From a study of the development of ovarian transplants in ovariectomized rabbits it was found that ovulation could be provoked without coitus in this animal by a single intravenous injection of an extract of the hypophysis or by a single intravenous injection of whole urine from pregnant women. Subcutaneous injections of the extract, or repeated intraperitoneal or intravenous injections of whole urine from a pregnant woman, usually caused luteinization of the follicles without ovulation.

Observations on the living eggs of the rabbit, G. PINCUS (*Roy. Soc. [London], Proc., Ser. B, 107 (1930), No. B 749, pp. 132–167, pls. 4*).—The results of observations on the fate of fertilized and unfertilized ova removed from the tubes or uteri of rabbits from 11 to 72 hours after copulation are reported.

These studies indicated that the ova, which are liberated about 10 hours after copulation, enter the tube and become grouped together by the adherence

of a mass of sticky cumulus cells. At about 17 hours after sterile copulation the ova separate, and by 24 hours after mating they acquire a considerable layer of albumen. Most tubal ova also contain from 1 to 3 polar bodies.

Ova enter the uterus 72 to 96 hours after copulation, and unfertilized ova undergo a rapid degeneration and are rapidly resorbed or washed out into the vagina. A few unfertilized ova gave evidence of segmentation in the uterus.

In fertile copulation the ova separate from the cumulus mass of cells somewhat more rapidly, and have only a thin deposit of albumen. By 19 hours after mating there are from 12 to 100 sperm stuck in the zona pellucida. Fertilized spermatozoa evidently enter the egg between 11.5 and 13 hours after copulation. The first segmentation division occurred at about 21 hours after mating. Almost all fertilized ova segmented regularly in vitro and developed as far as the morula.

Of the unfertilized ova cultured, 63.8 per cent developed beyond the one-cell stage on rabbit-blood plasma and chick-embryo extract and other media. Suggestions are given relative to changes in temperature, oxygen and carbon dioxide tension, and toxicity of medium as possible causes of parthenogenetic development.

A larger number of the ova removed soon after copulation showed regular development in vitro than when the interval between copulation and removal was increased.

In attempts to fertilize ova in vitro it was found that the sperm must penetrate the ova through the adherent follicle cells, as the albuminous coating prevents the entrance of spermatozoa. This was confirmed in mating trials with a vasectomized buck, followed in 14 hours by mating with a fertile buck. Females so mated produced no young.

Attempts to transplant culture-grown ova into does were unsuccessful.

The relation between the anterior pituitary body and the gonads, I, II, M. HILL and A. S. PARKES (*Roy. Soc. [London], Proc., Ser. B, 107 (1930), No. B 748, pp. 30–38, pl. 1; 39–49, pls. 3*).—Two papers are given.

I. *The factors concerned in the formation of the corpus luteum.*—One intravenous injection of extracts of the gonad-stimulating principle of the anterior pituitary body, prepared from urine of pregnancy, was found to produce ovulation freely in the nonmated rabbit. The pseudopregnancy following induced ovulation was normal in character and duration.

II. *The induction of ovulation in the anoestrous ferret.*—Urine extracts and acid and alkaline extracts of ox anterior pituitary tissue were tested as to their ability to induce ovulation in the anoestrous ferret. The 30 per cent alcohol soluble fraction of the anterior pituitary was the only one to induce ovulation, but some of the others caused the production of cystic follicles. The changes in the uterus, vagina, and vulva typical of oestrum occurred in case of ovulation and under certain other conditions. The corpora lutea developing after ovulation functioned normally. Pregnancy was not induced at ovulation in anoestrous females owing to the lack of spermatogenesis in males, although they copulated with the females in which oestrum had been induced.

The anterior lobe and menstruation, C. G. HARTMAN, W. M. FIROR, and E. M. K. GEILING (*Amer. Jour. Physiol., 95 (1930), No. 3, pp. 662–669*).—It was found that the ovarian hormone injection in young monkeys above one year of age produced oestrum and bleeding, but this effect was not obtained in hypophysectomized animals unless extracts of the anterior lobe were administered or the fresh gland implanted. It thus appears that menstrual bleeding is independent of the ovarian or corpus luteum hormone, but is the direct result of the hormonal action of the anterior lobe of the hypophysis.

As additional proof of hypophysectomy, it is stated in the addendum that the hypophysectomized monkeys were hypersensitive to insulin.

The problem of the origin of germ cells, F. Heys (*Quart. Rev. Biol.*, *6* (*1931*), *No. 1*, *pp. 1–45*, *figs. 19*).—A comprehensive discussion of the present information on the origin of the germ cells, with particular reference to ovarian regeneration in the rat. Experiments suggested that reported findings of the peritoneum as a source of regenerated ovarian tissue are more likely due to the incomplete removal of the ovary, complete removal being difficult in mature animals.

Studies on metabolism.—VIII, The effect of estrin injections on the basal metabolism, uterine endometrium, lactation, mating, and maternal instincts in the adult dog, M. M. Kunde, F. E. D'Amour, A. J. Carlson, and R. G. Gustavson (*Amer. Jour. Physiol.*, 95 (1930), No. 3, pp. 630–640, figs. 3).—Subcutaneous injections of oestrin did not influence the rate of basal metabolism, but congestion and enlargement of the external genitalia, hemorrhagic discharge from the vagina, hypertrophy of the uterine endometrium of secretory activity, evocation of the mating instinct, hyperplasia of the nipples, and enlargement of the mammary glands followed injection of oestrin into normal and castrated bitches. Lactation and maternal instinct were stimulated in one bitch.

The functions of the corpus luteum.—IV, The relation of oestrin to the luteal phase of the oestrous cycle, A. S. Parkes (*Roy. Soc.* [*London*], *Proc.*, *Ser. B*, *107* (*1930*), *No. B 749*, *pp. 188–196*, *pls. 3*).—In continuing this series (E. S. R., 63, p. 433) prolonged light and heavy doses of oestrin were administered to immature, ovariectomized, and pseudopregnant rabbits, and ovariectomized and anoestrous ferrets, the results of which demonstrated that the oestrous condition was induced, but none of the changes in the uterus or mammary gland characteristic of the luteal phase occurred. In pseudopregnancy it was also found that oestrin was not antagonistic to the action of the luteal hormone responsible for this condition.

Some physiological properties of a new tri-atomic alcohol from the urine of pregnant women, E. A. Doisy, J. M. Curtis, L. Levin, P. A. Katzman, and S. A. Thayer (*Soc. Expt. Biol. and Med. Poc.*, *28* (*1930*), *No. 3*, *p. 216*).—In these studies it was found that triatomic alcohol from the urine of pregnant women when administered enterically or subcutaneously to sexually immature rats or mice brought on the characteristics of oestrum in these animals within from 2 to 10 days. The amount of triatomic alcohol necessary to cause the opening of the vagina of 21-day-old rats was 0.0001 mg., and in the mouse 0.000004 mg.

The development and vascularisation of the corpus luteum in the mouse and rabbit, R. Deanesly (*Roy. Soc.* [*London*], *Proc.*, *Ser. B*, *107* (*1930*), *No. B 748*, *pp. 60–76*, *pls. 3*).—Based on a study of the corpora lutea in 22 ovaries of 12 mice and the ovaries of 4 rabbits, the early development of the corpora lutea up to the time when the lutein cells have reached their full size is described. The theca interna of the follicles appears to play the major rôle in vascularization, but the theca externa also takes part.

The origin of the blood of the "placental sign," E. S. Stafford (*Anat. Rec.*, *47* (*1930*), *No. 1*, *pp. 43–57*, *pls. 3*).—In a study of the origin of uterine bleeding recognized as the placental sign, the uteri of mated rats were injected through the descending aorta with India ink after bleeding the animal from the right ventricle. Guinea pigs, rabbits, cats, and dogs were also used.

The uterine bleeding was traced to the rupture of dilated vessels at the paraplacental border with the destruction of the overlying epithelium. This occurred at 12 to 15 days of pregnancy.

There was no free ink in the uterus of guinea pigs, but it was observed in the rabbit on the eleventh day of gestation. In the dog and cat the ink escaped from the vessels near the hematomas surrounding the placenta.

FIELD CROPS

A comparative study of Student's method and Bessel's formula, J. P. Conrad (*Jour. Amer. Soc. Agron., 22 (1930), No. 11, pp. 949–962, fig. 1*).—Comparisons made at the University of California showed that the difference in odds obtained from the same data by the two methods is due to the method of computing odds, the handling of correlation, and differences in the functions, especially for small numbers.

[Field crops experiments at the South Mississippi Substation, 1930], J. C. Robert, W. W. Welborne, and J. L. Cooley, jr. (*Mississippi Sta. Bul. 285 (1930), pp. 2–24, 27, 28, 30, 31, fig. 1*).—Results are reported for 1930 from variety tests (E. S. R., 63, p. 28) with cotton, corn, sugarcane, soybeans, and winter legumes; fertilizer tests with corn, oats, potatoes, and sweetpotatoes; selection work with potatoes and sweetpotatoes; and the growing of cotton after winter legumes and after potatoes. Fertilizer experiments with cotton dealt with carriers of nitrogen, potassium, and phosphorus and comparisons of high and low analysis, factory v. home mixed fertilizers, and of various formulas.

[Field crops experiments at the Raymond, Miss., Substation, 1930], H. F. Wallace (*Mississippi Sta. Bul. 287 (1930), pp. 2–14, 19, 20*).—Cotton varieties found good for hill land included Cleveland 54, D. & P. L. Nos. 8 and 10, Stoneville 2 and 3, Lone Star, Wilson Type, and Cook 1010, and for valley land Delfos 6102 and its progenies, strains of Lone Star, and Stoneville, Miller, Cleveland 54, Express 121, D. & P. L. Nos. 6 and 8, Roldo Rowden, and Missdel 2. Fertilizer tests with cotton indicated for general conditions 600 lbs. per acre of a 6–8–4, on old cotton lands where cotton rust or where lespedeza has preceded cotton 8 per cent of potash instead of 4, and on land heavily infested with nut grass or Johnson grass half the nitrogen applied before planting and the rest as side-dressing after chopping. Where legumes have been grown and turned under 4 per cent of nitrogen in a formula should suffice. Comparisons of factory v. home-mixed fertilizers, nitrogen, phosphorus, and potassium sources, and cotton after different winter legumes are also noted. Spacing tests during 5 years indicated 2 to 3 stalks in bunches per foot in 3.5-ft. rows on valley land and 3 to 5 stalks in bunches per foot in 3-ft. rows on hill land.

Laguna, Cocke Prolific, and Paymaster led corn varieties over 9 years, and College 47 was foremost in 1929 and 1930. A fertilizer mixture advised for corn includes superphosphate 100 lbs., sodium nitrate 150 lbs. or its equivalent and potassium chloride 50 lbs. Sodium nitrate, calcium nitrate, and urea led the nitrogen carriers compared for corn.

Other activities (E. S. R., 63, p. 28) described were variety trials with soybeans, winter legumes, oats, and wheat, fertilizer tests with alfalfa, pasture studies, and crop rotations.

Experiments with alfalfa, clover, and timothy for hay in New Jersey, H. B. Sprague, E. E. Evaul, H. W. Reuszer, and N. F. Farris (*New Jersey Stas. Bul. 512 (1930), pp. 38, figs. 6*).—The current status of and climatic conditions affecting hay production in New Jersey are discussed, with accounts of the behavior of varieties of alfalfa, timothy, and clover in comparative tests. Alfalfa when grown under suitable conditions is indicated as the most profitable forage crop for the State.

Hardigan, Grimm, and Cossack alfalfa seemed best for northern New Jersey

prices are equal. Strains of common alfalfa from Kansas or regions with climate not more severe than that of Kansas are not advised for northern New Jersey. Hardigan was the only variegated sort tested which may be more valuable in southern New Jersey than Kansas Common. Common alfalfas from regions with mild climates did not appear suitable for New Jersey, and commercial seed of alfalfa of unknown origin consistently gave inferior results. Comparisons of the various alfalfas in each test showed no consistent differences in their moisture contents. The moisture content of the plants seemed to depend almost entirely on the type of growth produced by the soil and season and on the abundance of soil moisture at cutting. In no case was the moisture loss during curing less than 55 or more than 70 per cent of the green weight. Evidently it is necessary to vaporize from 2,440 to 4,650 lbs. of water for each ton of cured hay produced, indicating that great care is needed to produce high quality of hay in a humid climate.

Although many of the timothy selections developed in Ohio or New York did not surpass or were distinctly inferior to common timothys, Cornell 4123 yielded 408 lbs. per acre more with a much heavier aftermath, and Cornell 4059, 510 lbs. more, and was ready for harvest about one week later, thereby not competing with corn cultivation and wheat harvest for labor.

Native strains of red clover, although varying considerably in suitability for New Jersey, were superior to imported strains. When fall sown, several red clover strains from central and northern Europe were winter hardy and yielded nearly as much hay as American strains. In a 1-year test, red clover seed from European countries other than Italy died out in summer when spring sown with grain, and yielded less than half as much hay as native adapted clover during the next year. Italian red clover seed seemed definitely unsatisfactory for the region. With favorable soil conditions red clover yielded 30 per cent more hay than alsike when sown alone in the fall and 100 per cent more when spring seeded with a nurse crop.

The artificial reseeding of New Mexico ranges, C. P. Wilson (*New Mexico Sta. Bul. 189 (1931), pp. 37, figs. 13*).—Range improvement studies in different localities indicated that chamiza (*Atriplex canescens*) (E. S. R., 60, p. 36), blue grama grass (*Bouteloua gracilis*), and in the colder sections, smooth bromegrass are among the most promising species for artificial reseeding in New Mexico. Other plants possibly of considerable merit for the purpose were crested and slender wheatgrasses (*Agropyron cristatum* and *A. tenerum*), bulbous bluegrass (*Poa bulbosa*), timothy, winter fat (*Eurotia lanata*), salt sacaton (*Sporobolus airoides*), and in the less arid localities of southern New Mexico, *Valota saccharata*. Although Johnson grass and Bermuda grass furnished much forage on some ranges and reduced erosion, they both are troublesome weeds in irrigated valleys of southern New Mexico. Yellow-flowered sweetclover also may be of value for range improvement in sections with comparatively high precipitation. Efforts to get alfilaria (*Erodium cicutarium*) established on more ranges also appeared to be justified, although many past attempts were unsuccessful.

Artificial reseeding in New Mexico, especially where much vegetation is already on the land, usually requires plowing or similar soil preparation before planting. At least one or two cultivations for weed control also may be essential early in the growing season. Plat tests and the experience of stockmen indicated that some of the ranges can be improved materially, however, merely by broadcasting chamiza or blue grama grass seed, with little or no soil preparation.

The seeds of many New Mexico range forage plants were observed to germinate considerably better than generally supposed. During the rainy

season a stand of some of the best species usually can be obtained with little difficulty, while at the lower altitudes of the southern part of the State the young plants generally die during the drought of the following spring or early summer. Chamiza and winter fat seeds germinate during the fall and winter, and many seedlings, especially of chamiza, if on suitable soil, survive such drought. The results of germination tests of range plant seeds from 1924–1930, inclusive, are appended, with notes on seed sources, planting instructions, and the chemical composition of several of the plants studied, including analyses of blue grama grass, *V. saccharata*, wild mustard (*Sophia ochroleuca*), winter fat, and chamiza.

The protein content of grass, chiefly meadow foxtail (Alopecurus pratensis), as influenced by frequency of cutting, F. T. Shutt, S. N. Hamilton, and H. H. Selwyn (*Jour. Agr. Sci.* [*England*], *20* (*1930*), *No. 1, pp. 126–134, fig. 1*).—Results in the second season (1928) of cutting tests on a meadow at the Central Experimental Farm at Ottawa, considered together with the data from 1927 (E. S. R., 59, p. 828), indicated that the application of fertilizers in which nitrogen predominated greatly aided to maintain vigorous growth. The protein content of the herbage increased with the shortening of the period between cuttings. In the first season, when the herbage was essentially grass, the more frequent cuttings tended to reduce the protein yields. In the second season, when clover replaced grass, roughly in proportion to the curtailing of the growing period, the higher protein content of the legume tended to counteract the depressing effect of frequent cutting on yield. The yield of dry matter per unit area decreased with frequency of cutting. In both seasons the largest yield of dry matter was obtained from the plat cut as hay with aftermath.

Height of stubble and straw yields of small grains, J. W. Taylor and J. H. Martin (*Jour. Amer. Soc. Agron.*, *22* (*1930*), *No. 11, pp. 963–967, figs. 2*).—Determinations made at the Indiana Experiment Station on bundles of wheat and oats and at Arlington, Va., on wheat, oats, barley, and rye revealed that in a fairly uniform field of grain about 60 to 80 per cent of the straw and chaff is to be found below the level of the lowest heads. Straw weights appeared to decrease rapidly with higher cutting, largely because the culms decrease in thickness upward from the base to the peduncle. Sometimes 3.5 times as much straw is harvested in cutting a lodged crop with a combine as in harvesting an erect crop. Straw-yield data from experimental plats seemed to be of limited value unless the height of cutting is uniform.

"Dry inoculants" for alfalfa, W. A. Albrecht (*Jour. Amer. Soc. Agron.*, *22* (*1930*), *No. 11, pp. 916–918*).—The nodulation resulting at the Missouri Experiment Station from various methods of applying commercial dry inoculants to alfalfa seed did not equal that from agar cultures or soil cultures and scarcely exceeded that which occurred by chance. These preliminary trials seemed to suggest the danger of getting ease of manipulation at the cost of efficiency in nodule production.

Barley in Colorado, D. W. Robertson, A. Kezer, F. A. Coffman, J. F. Brandon, D. Koonce, and G. W. Deming (*Colorado Sta. Bul. 371* (*1930*), *pp. 37, figs. 5*).—Variety tests with barley over extended periods indicated for irrigated conditions resembling those at the station the Trebi, Colsess, Coast, and Comfort varieties; for high-altitude irrigation, as at Fort Lewis, Trebi, Colsess, and Coast; and from studies at Akron (E. S. R., 52, p. 827), in cooperation with the U. S. Department of Agriculture, for dry land Club Mariout, Coast, White Smyrna, and Flyna. Cultural methods and irrigation practices deemed suitable for the several regions are outlined, and agronomic data are presented for the several varieties tested.

The date to plant corn in Colorado, D. W. ROBERTSON, A. KEZER, and G. W. DEMING (*Colorado Sta. Bul. 369 (1930), pp. 8, figs. 3*).—Planting tests indicated that corn for highest yield and best quality should be planted between April 20 and May 10, averaging May 1, in irrigated sections of Weld, Boulder, and Larimer Counties. Corn planted early matures early in the fall and has not been injured permanently by late frosts since 1921. Damage from western corn root worm (*Diabrotica virgifera*) indicated that it is not safe to grow corn after corn in this section on irrigated land. The insect damage to corn increased as the planting date was later in the season.

Corn growing in Michigan, H. C. RATHER and J. R. DUNCAN (*Michigan Sta. Spec. Bul. 210 (1931), pp. 35, figs. 18*).—Replacing Bulletin 289 (E. S. R., 44, p. 828), this publication indicates the principal corn sections of Michigan, describes the leading varieties and their probable adaptations, and gives information on the selection, preservation, testing, and treatment of seed corn, production practices, and utilization of the crop for silage, on corn judging, and on the cost of growing corn in the State. Varieties indicated as desirable for various conditions include Clement White Cap, Duncan Yellow Dent, Polar Dent, M. A. C. Yellow Dent, Pickett Yellow Dent, Golden Glow, and Jewett 8-Row Flint, all listed for inspection by the Michigan Crop Improvement Association, and also Ferden Yellow Dent, Northwestern Dent, Wisconsin No. 25, Longfellow Flint, and King Phillip Flint.

Maize in South Africa, A. R. SAUNDERS (*[Johannesburg]: So. Africa Cent. News Agency, 1930, pp. 284, pls. 72, figs. 14*).—Designed for conditions in South Africa, this volume presents information on the history and relationships of corn, the status of corn production in the Dominion, its climatic, soil, fertility, and cultural needs, its botanical characteristics, varieties, diseases, insect pests, inheritance and improvement, utilization, and marketing.

Cotton variety summary, 1926–1930, J. F. O'KELLY and W. W. HULL (*Mississippi Sta. Bul. 288 (1930), pp. 8*).—Varieties of cotton (E. S. R., 63, p. 34) included among the leaders in average acre yields of lint at the station and hill substations during the period 1926–1930 were Cleveland 54, D. & P. L. Nos. 4–8 and 6, Half and Half, Delfos, Lone Star, and Wilson Type. Among the leaders in acre value were D. & P. L. 6, Delfos, Cleveland 54, D. & P. L. 4–8, Express, Lone Star, and Deltatype Webber. Yields and other agronomic data are shown for varieties tested in 1930 at the station. Comparisons at the station and elsewhere showed Red Leaf cotton to yield less than Cleveland 54 or Miller 589. Red Leaf is also objectionable in communities producing pure seed for sale.

Reports [on cotton investigations] received from experiment stations, 1929–1930 (*London: Empire Cotton Growing Corp., 1931, pp. XI+342, pls. 6, figs. 55*).—Research with cotton (E. S. R., 63, p. 227) conducted under the auspices of or by officials connected with the Empire Cotton Growing Corporation is reported on from Biloela, Queensland; Barberton and Magut, South Africa; Bremersdorp and Ingwavuma, Swaziland; Gatooma, Southern Rhodesia; Mazabuka, Northern Rhodesia; Shambat and elsewhere in Anglo-Egyptian Sudan; Uganda; Makwapala, Port Herald, and Domira Bay, Nyasaland; Daudawa, Nigeria; and Sigatoka, Fiji.

The operation of the seed control law upon the pedigree of cotton seed in seasons 1926 to 1930, with a discussion of evasions of the law, W. L. BALLS and ARMENAG EFF. BEDEVIAN (*Egypt Min. Agr., Tech. and Sci. Serv. Bul. 104 (1931), pp. [1]+28, pls. 21*).—The second report on the subject (E. S. R., 61, p. 826) is presented.

Jute, I, E. NONNENMACHER (*Die Jute.—I. Abt., Pflanze und Fasergewinnung Handel und Wirtschaft Spinnerei. Berlin: Julius Springer, 1930, pp. VIII+571,*

figs. 542).—The botanical, agricultural, and commercial relations of jute are outlined, and the physical, chemical, and technological characteristics of jute fiber are described. The greater portion of the book is devoted to an exposition of the processes and machinery involved in preparing the raw fiber and spinning it into yarn.

Oat varieties in Colorado, D. W. Robertson, A. Kezer, F. A. Coffman, J. F. Brandon, D. Koonce, and G. W. Deming (*Colorado Sta. Bul. 370 (1930), pp. 34, figs. 3*).—Experiments with oats over a prolonged period at the station under irrigation showed the midseason type to be best adapted. Colorado No. 37, a station selection resembling Swedish Select, yielded highest in 1918–1927. Seeding 80 lbs. per acre April 1 to 20 or a little later for some of the early varieties is advised, and under normal conditions a single irrigation at the jointing stage is indicated. If two irrigations be applied, one is recommended at tillering and one at the late jointing stage.

At Fort Lewis in southwestern Colorado, midseason types, including Great Dakota, Colorado No. 37, Swedish Select, and Golden Rain gave good yields.

Investigations with oats on dry land at Akron (E. S. R., 52, p. 827) from 1908 to 1927 were in cooperation with the U. S. Department of Agriculture. Only early maturing varieties produced favorable yields. Kherson and Brunker, a selection from Burt, made good yields, and the more recently introduced Fulghum and Kanota were promising. Results indicated early spring seeding of from 4 to 6 pk. per acre. Fallowing was unprofitable compared with disked corn ground. Oats are not recommended for extensive seeding on dry land, since either corn or barley generally produces more grain. Oats may, however, be cut and fed as hay when drought prevents the crop from developing properly.

The lodging of soybeans, F. A. Welton and V. H. Morris (*Jour. Amer. Soc. Agron., 22 (1930), No. 11, pp. 897–902, fig. 1*).—Soybean plants grown at the Ohio Experiment Station under the influence of reduced light as under shade or in corn contained less dry matter and less total carbohydrates than those grown in the open. The reduction in total carbohydrates, and, therefore, indirectly in total dry matter, was due in general to the development of less easily hydrolyzable carbohydrates, less cellulose, and less lignin, all products contributing either directly or indirectly to toughness and rigidity of stems. The stems with low content of dry matter were relatively soft, succulent, pliable, and inclined to lodge.

Transplanting sugar beets in Utah and Idaho, S. B. Nuckolls (*U. S. Dept. Agr. Circ. 156 (1931), pp. 15, figs. 3*).—Experiments in Idaho and Utah from 1925 to 1929 to test the feasibility of using machine transplanters as a field practice in setting sugar beets indicated that sugar beet yields probably can be increased from 1 to 8 tons per acre by proper transplanting methods. Sugar production per acre generally favored the transplanted beets for the period of the tests, and strongly so for the large-scale tests of 1929, considered a safe index of advantages derived from transplanting sugar beets. Transplanting is not recommended as a method to supplant present practices, but attention is called to the possibilities of the method.

Plants used as sets, according to the test findings, should be between 8 and 12 weeks old at transplanting and should have from 12 to 14 leaves. Best results were had when the crown of the beet was set even with or below the soil surface and when water was applied directly to the root in transplanting. Beet roots obtained by transplants in the tests were short, round, and more branched than those obtained under the commercial method, yet this shape was not associated with a serious decline in quality. The fact that infection of

sugar beets by curly top, occurring in the 1928 experiments, appeared to harm the transplanted sugar beets less than the field-sown checks, may be of significance in relation to curly top control.

Methods of seed production from sugar beets overwintered in the field, J. C. OVERPECK and H. A. ELCOCK (*U. S. Dept. Agr. Circ. 153 (1931), pp. 22, figs. 10*).—Additional information on seed production from sugar beets overwintered in the field (E. S. R., 53, p. 832) is reported from continued tests in cooperation with the New Mexico Experiment Station. Results of commercial plantings also are described briefly, and practices are recommended for soil selection, field preparation, cultivation, irrigation, harvesting, and seed cleaning in sugar beet seed production in the Rio Grande Valley of southern New Mexico.

Planting between August 15 and September 15, 18 lbs. per acre, in 22-in. rows gave good results. Closer spacing of rows, 7 in., with a heavier seeding rate, 44 lbs., in which a grain drill was used proved successful experimentally. The viability of sugar beet seed produced in the area varied considerably because of conditions which need close study. A preliminary test showed that frequent irrigation during the blooming period may be significant in the production of seed of acceptable viability.

The use of the refractometer in cane seedling selection work, N. CRAIG (*Internatl. Sugar Jour., 33 (1931), No. 385, pp. 14–17*).—The refractometer, according to results at the Sugarcane Research Station in Mauritius, can be used advantageously in sugarcane seedling work. The sampling method—cutting a core from the cane at selected points by a cork borer about 5 mm. in diameter, squeezing the core by a pair of cutting pliers, and placing the juice on the prism of a Zeiss refractometer—is described as rapid, reliable, and easy of application. The taking of six borings from each stool is advised, although analyses of three borings sufficed for a fair indication of the sugar-producing capacity of a seedling.

Chemical investigations of the tobacco plant.—II, The chemical changes that occur during the curing of Connecticut shade-grown tobacco, H. B. VICKERY and G. W. PUCHER (*Connecticut State Sta. Bul. 324 (1931), pp. 203–240, figs. 5*).—The studies on the changes occurring during the curing of tobacco were made on material derived from five 50-kg. lots of fresh leaves of Connecticut shade-grown tobacco consisting of the eighth to eleventh leaves, counting from the bottom of the plant, collected August 1, 1929, at the Tobacco Substation and analyzed, respectively, when fresh, when cured 12 days, 18 days, and 51 days, and when fermented.

Under the experimental conditions 50 kg. of fresh leaf lost about 42 kg. of water, or 96.4 per cent of the amount initially present in the tissue. The loss of organic solids which took place amounted to nearly 20 per cent of the total solids of the fresh leaf. The original 6.47 kg. of solids diminished to 5.19, the loss falling largely upon the organic solids of the extracted residues of the leaf tissue in the press cakes, i. e., upon the protein and originally insoluble carbohydrate of the leaf. A considerable part of the coagulable protein and insoluble carbohydrate apparently passed into a soluble form, and an equivalent quantity of substance then underwent transformation ultimately to carbon dioxide, water, and ammonia or other volatiles which escaped from the tissues. About 22 per cent of the nicotine also evaporated from the tissues.

Over 81 per cent of the apparent soluble carbohydrate of the fresh leaf, largely a sugar that yields phenylglucosazone, disappeared as such. The crude fiber of the leaves apparently did not undergo change. The ether-soluble material diminished rapidly in amount, and about 33 per cent of the initial quantity

disappeared in the early stages of curing. The behavior suggested that some of the loss was due to a conversion of chlorophyll into substances of which some were only partly soluble in ether, and that changes in other ether-soluble constituents also must have occurred whereby these became insoluble in ether.

Changes in the distribution of nitrogen in the leaf indicated that much of the leaf protein underwent hydrolysis to amino acids, and that these subsequently were important in the formation of amides and ammonia. The oxidative deamination which probably occurred was followed by amide synthesis, and at least 23.9 per cent of the nitrogen of the leaf were involved in such changes. Probably nearly one-third of the protein nitrogen of the leaf passed through this series of reactions. Of the 14.6 per cent of the total leaf nitrogen lost, only 1.5 per cent could be accounted for as the evaporation of nicotine. The remainder probably represented a direct loss of ammonia from the cells. The results suggested that amino, ammonia, and amide nitrogen attained concentrations such that equilibrium was reached in the sense that loss of ammonia compensated amino nitrogen formation from the hydrolysis of the protein. Much, if not all, of the amino nitrogen apparently passed through the intermediate step of amides, and the isolation of asparagine suggests that this amide may have acted as a detoxicating or neutralizing agent for the ammonia. The nitrate nitrogen of the leaf apparently changed but little during curing. There was evidence of the presence of amides in curing tobacco that are much less stable than asparagine. The possibility is suggested that the amide of glutamic acid or of hydroxyaspartic or hydroxyglutamic acid may have been present.

Monantha vetch, R. McKee, H. A. Schoth, and J. L. Stephens (*U. S. Dept. Agr. Circ. 152 (1931), pp. 14, figs. 2*).—The characteristics and climatic and soil needs of monantha vetch are indicated, and its value for hay, green manure, and pasture and its cultural and harvesting requirements are described from results of work in cooperation with the Georgia Coastal Plain, Florida, and Oregon Experiment Stations. Insect enemies and fungus diseases are noted briefly.

The monantha vetch, first introduced into the United States by the U. S. Department of Agriculture in 1898, in general growth habit resembles common and hairy vetch and is adapted to the mild regions of the Pacific Coast States and to the southern parts of the Gulf States. Seed production has been successful in Pacific States but not in the southeastern States. The seed is edible and similar to lentils in this regard. This vetch grows at a lower temperature than hairy vetch or common vetch, and for this reason is desirable for winter green manure in areas having mild winters. Seeding in the southern and western United States should be done in the fall at rates of from about 30 to 70 lbs. per acre, depending on climatic conditions and the purpose of the crop. As hay and pasturage monantha vetch resembles common and hairy vetch.

Inheritance of winterhardiness, growth habit, and stem-rust reaction in crosses between Minhardi winter and H-44 spring wheats, K. S. Quisenberry (*U. S. Dept. Agr., Tech. Bul. 218 (1931), pp. 46, pls. 3, figs. 5*).—The segregation for winter hardiness, winter-growth, and spring-growth habit, rust reaction, and other plant characters was determined in progenies of crosses between H-44, a spring wheat selected from a Marquis × Yaroslav-emmer cross made in 1916 by E. S. McFadden, and Minhardi, a winter wheat selected from an Odessa × Turkey cross at the Minnesota Experiment Station.

Field studies on winterhardiness were made at the Minnesota Experiment Station and at Moccasin, Mont. In general the same condition, largely low temperature, appeared to cause the winterkilling at both places. The character winterhardiness seemed to be controlled by several genetic factors, the final

expression being influenced greatly by the environment. In laboratory freezing tests the F_4 lines ranged in cold resistance from the tenderness of the H–44 parent to the hardiness of Minhardi, with a preponderance of tender lines. A correlation of +0.713±0.031 obtained between cold resistance, as measured by the laboratory freezing test, and field survivals showed that cold resistance was the principal character determining winterhardiness.

In growth-habit studies on F_2 and F_3 material, limited F_3 data indicated a ratio of 15 spring-growth to one winter-growth habit. A genetic explanation for growth-habit segregation in F_3, suggested by assuming duplicate dominant factors for spring-growth habit, H–44 (spring) having the genotype *AABB* and Minhardi (winter) having the genotype *aabb*, was adequate for the results obtained. The presence of a dominant factor or factors appeared to give spring forms varying in earliness from those as early as H–44 to those which head very late. Winter-growth habit was correlated with winterhardiness, as expressed by both field and laboratory tests, yet the association was not complete.

A single factor difference for rust resistance and susceptibility was indicated by F_2 results from material grown from both fall and spring sowing, yet F_3 studies proved this explanation inadequate; besides the major genetic factor involved, other minor modifying factors evidently were needed to explain the reaction. Little relation existed between the rust reaction of a line when fall sown and when spring sown, indicating the presence of different forms of rust or a different expression of the genetic factors due to the different length of the growing period. Although a segregation approximating one resistant, two segregating, and one susceptible was obtained in the greenhouse from F_3 lines inoculated with physiologic form 60 of stem rust, there was an indication of minor factors influencing the expression of rust reaction, even in the greenhouse. The lines behaved the same when inoculated with form 36, showing that the same factor or factors control the reaction of the seedlings to forms 36 and 60. No close relation was evident between the greenhouse seedling reaction and the reaction of the mature plants in the field, the data indicating the presence of additional factors for mature plant reaction in the field.

The F_3 lines that survived the winter at St. Paul, Minn., started heading before Minhardi and continued later, the mode for heading in the hybrids being earlier than that of the winter parent. At Moccasin the hybrid lines began heading 6 days before Minhardi, most being headed before Minhardi started. The H–44 greenhouse seedlings have a purple coleoptile, while seedlings of Minhardi have a green coleoptile. The ratio of 15 purple or segregating lines to 1 homozygous green line obtained in the F_3 indicated dominant duplicate factors, it being assumed that H–44 has the genetic constitution P_1P_1 P_2P_2 and Minhardi p_1p_1 p_2p_2. H–44 is awned, while Minhardi is awnless or awnleted, with a single genetic factor apparently being involved.

Inspection of agricultural seeds, H. R. Kraybill, O. S. Roberts, R. O. Bitler, R. B. Schulte, E. M. Patt, and P. Balbach (*Indiana Sta. Circ. 177 (1930), pp. 99, fig. 1*).—The purity, germination percentage, weed seed content, and for legumes the hard seed content are tabulated for 1,045 official samples of agricultural seed collected from dealers in Indiana during the year ended June 30, 1930.

Seed inspection, F. A. McLaughlin (*Massachusetts Sta. Control Ser. Bul. 56 (1930), pp. 42*).—The germination, purity, and weed seed contents are tabulated for 349 official samples of agricultural seed collected in Massachusetts during the year ended October 1, 1930. Samples of onion seed, red clover, sweetclover, and alfalfa were also tested for trueness to type.

Results of seed and legume inoculant inspection, 1930, J. G. FISKE (*New Jersey Stas. Bul. 516 (1931), pp. 95*).—The germination percentage, purity, and other information are tabulated for 1,499 official samples of seed of field crops, vegetables, and lawn mixtures obtained from dealers in New Jersey in 1930, and the crops, inoculation and purity, number of organisms, and viabilities are shown for 75 official samples of legume inoculants.

Further studies on the hard seed problem: Alfalfa and sweet clover, C. W. LEGGATT (*Sci. Agr., 11 (1931), No. 7, pp. 418–427*).—Further studies (E. S. R., 61, p. 225) at Brooks and Lacombe, Alta., confirmed earlier observations (E. S. R., 59, p. 627) that in alfalfa hard seeds may be considered equal to the permeable seed in value. The greater yields usually obtained from unscarified as compared with scarified seeds were not deemed necessarily significant with respect to hard seededness. Hard seeds produced plants slightly less winter hardy than those from permeable seeds.

Control of quack grass by tillage.—I, A progress report, Langdon tillage project; II, General suggestions on control of quack grass, T. E. STOA, V. STURLAUGSON, and H. F. MCCOLLY (*North Dakota Sta. Bul. 244 (1930), pp. 19, figs. 4*).—Experiments on the control of quack grass by tillage on fine sandy loam at Langdon in 1928, 1929, and 1930, made it evident that spring tillage for a spring-sown crop or late fall tillage was not a satisfactory means for destroying quack grass in the area. Early fall tillage seemed more promising than late tillage and should be practiced on land that can not be summer fallowed. Summer tillage where feasible appeared to be an effective control method. The degree of control obtained or completeness of destruction is in direct proportion to the thoroughness of tillage, the timeliness of the operation, and the favorableness of climatic conditions. While the type of implement used seemed of secondary importance, the limited operations showed that the one-way disk tiller gave the most promising control at the least cost. The field cultivator (duckfoot) and plow methods, with disking, when well done were only slightly less efficient, although more costly. Late seeded buckwheat used as a smother crop and plowed under gave good results when the stand of quack grass was reduced considerably before seeding.

Information also is included on the characteristics of the weed, control in small areas, control of soil blowing, use of smother crops, and on the merits of late summer or early fall tillage.

HORTICULTURE

[Horticulture at the South Mississippi Substation], J. L. COOLEY, JR. (*Mississippi Sta. Bul. 285 (1930), pp. 25, 26, 27, 28–30, 32*).—In this progress report (E. S. R., 63, p. 38) tabulated results are presented from varietal testing work with blueberries, grapes, watermelons, peaches, roses, pecans, apples, and other horticultural crops. Peach trees grown under the sod mulch system made only about half the growth of trees under clean culture and produced but little fruit, whereas figs mulched with straw produced 95 per cent more fruit and 50 per cent more foliage than did figs under clean culture. Winter injury to the figs was much less in the straw mulched plat.

[Horticultural work at the Raymond, Miss., Substation], H. F. WALLACE (*Mississippi Sta. Bul. 287 (1930), pp. 14–19*).—Data are presented on the results of varietal and fertilizer trials with tomatoes, garden peas, and snap beans. The most productive varieties in the three species were, respectively, Norton, Thomas Laxton, and Burpee Stringless. On the basis of results obtained fertilizer recommendations are made for the three crops.

Analyses of materials sold as insecticides and fungicides during 1930, C. S. CATHCART and R. L. WILLIS (*New Jersey Stas. Bul. 513 (1930), pp. 16*).—The results are presented of the examination of samples of insecticides and fungicides collected during the inspection of 1930.

The waste sulphite material of paper mills as an adjuvant to certain spray materials, R. H. HURT (*Virginia Sta. Bul. 277 (1931), pp. 10, fig. 1*).—A discussion of the properties and uses of lignin or sulfite pitch, a by-product of paper and pulp mills which has been found to be an excellent emulsifying agent in the preparation of oil sprays and a suspending agent in various other spray mixtures. One lb. of the powder or 1 qt. of the liquid to each 50 gal. of solution was found ample as a suspending and wetting agent, but as much as 2 lbs. or 2 qts. were used without resulting injury to the plants.

Breeding experiments with the cucumber (Cucumis sativus L.), W. J. STRONG (*Sci. Agr., 11 (1931), No. 6, pp. 333–346, figs. 7*).—Work conducted at the Horticultural Experiment Station, Vineland, Ont., upon the mode of inheritance of various characters in the cucumber led to the general conclusion that the cucumber in common with other plants possesses characters of varying degrees of complexity as regards inheritance. A few characters were transmitted in simple Mendelian form, while the majority were not. Among dominant characters were wartiness of fruit, black spines, thick skin, and mottling. Among characters apparently inherited on a multiple factor basis were size of leaves, color of leaves, length of internodes, length of fruits, size of spines, and length of fruit stalk. Shape of fruit appeared to be dependent on several factors, but its exact mode of inheritance was not determined. Linkage was noted between the fruit characters mottled, dull, warty, thick, and tough on the one hand, and nonmottled, glossy, nonwarty, thin, and tender on the other.

Growing greenhouse tomatoes, E. F. BURK and R. H. ROBERTS (*Wisconsin Sta. Bul. 418 (1931), pp. 20, figs. 16*).—This is a general discussion of the physiological principles underlying various growth and fruiting responses in the tomato and also underlying various practices employed in its culture. The length of pistil is shown to be a factor in the pollination of the winter crop in that varieties with short pistils not extending beyond the anthers are self-pollinating. It is pointed out that fruit setting varies with plant vigor, those plants of intermediate vigor being most productive. The carbohydrate-nitrogen theory is discussed in relation to growth and fruiting and to cultural practices at different seasons. It is shown that under conditions of intense light the tomato plant can utilize to advantage much more nitrogen than under subdued light. Varieties were observed to differ in their response to a given environment, suggesting the desirability of breeding varieties adapted to special conditions, such as late autumn growing. In shading experiments in the field varieties responded differently; the Fargo, for example, showed increased growth and fruiting under shade which reduced the yield of Marglobe.

Field and laboratory studies of the pollination requirements of varieties of deciduous fruit trees grown in South Africa, O. S. H. REINECKE (*Union So. Africa Dept. Agr., Sci. Bul. 90 (1930), pp. 92, figs. 21*).—In addition to a comprehensive discussion of the fruit pollination problem, there are presented data on the results of experiments with various deciduous fruits. In general it was evident that self-fruitfulness in a given variety is not a constant character, although certain pears and apples were self-unfruitful under all conditions. Many self-fruitful pears were found to form fruits parthenocarpically, and certain varieties, such as Bon Chretien (Bartlett) and Kieffer, regularly exhibited this tendency. On the other hand, self-fruitful apples, plums, and peaches generally contained seeds which in the pear were a decided factor in

the size and shape of the fruit. In no case did the male parent exert any immediate effect on color, shape, flavor, or ripening of the resulting fruit. In pollen germination studies with pears and plums in a 15 per cent cane sugar medium, the addition of a portion of the stigma had a stimulating effect on the percentage of germination and the length of the tubes.

All varieties of almonds and cherries tested were self-unfruitful. Quinces, apricots, and peaches were generally self-fruitful, while in plums, pears, and apples the results were widely divided. The Elberta peach proved only partially self-fertile.

Effects of pruning on the growth and yield of cherry trees, H. L. Crane (*West Virginia Sta. Bul. 240 (1931), pp. 20, figs. 2*).—In a series of experiments begun with Schmidt sweet cherries and Montmorency sour cherries but from which the sweet cherries were eliminated before fruiting age by severe winter injuries, the fact was established that severe dormant pruning or summer pruning of any type reduced the growth of the cherry and in the case of the sour variety reduced yields.

Maximum shoot growth in the sour cherry and maximum trunk growth in the sour and sweet cherries were attained in those trees which received the least pruning, namely, a light corrective dormant treatment. In the first year of bloom these trees produced by far the largest percentage of flowers, 58.7, as compared with 24.2 for the next group. The correctively dormant pruned trees led in production each year. In relation to winter injury limbs that were girdled by freezing bore flowers the pistils of which apparently had greatly increased resistance to low temperature. The girdled limbs bloomed several days earlier than those of other trees.

Length of the fruit development period of the Elberta and some other varieties of peaches, M. A. Blake (*New Jersey Stas. Bul. 511 (1930), pp. 24, figs. 3*).—Data taken on the time of full bloom and on the height of the picking season of Elberta peaches for 10 consecutive years at Vineland showed definitely that the earlier the bloom the longer the time required to reach maturity. The average period for the 10 years was 130.5 days with a minimum of 123 and a maximum of 144. As established at New Brunswick, April and May temperatures had the most marked effect on the length of the developmental period. This is ascribed to the fact that in these months there are many hours when temperatures are unfavorable to the active growth of the peach.

In pointing out that various other factors besides temperature function in determining the length of the developmental period the author discusses three types, 1, 2, and 3, resulting from differential fertilizer treatments. Type 1 trees on plats receiving no nitrogen required 126.5 days to reach first picking as compared with 128.3 and 129.3 days for types 2 and 3, the last types being on moderate and heavily fertilized soils, respectively. The lengths of the picking season for the three types were 8, 5.22, and 5.88 days, respectively.

Data are presented to show the great variation existing in the rate of growth and ultimate length of twigs on a single peach tree and the rôle of factors, such as pest injuries, girdling, percentage of set, varieties, etc., in affecting the developmental period. Alton and Mayflower, for example, were able to grow at about a normal rate at temperatures which definitely inhibited Reeves, Mountain Rose, and Elberta. In general conclusion the author asserts the possibility of predicting rather accurately as early as July 1 the prospective harvest period of the Elberta peach at Vineland.

Pollination of the President plum, A. H. Hendrickson (*Blue Anchor, 8 (1931), No. 2, pp. 6, 7, figs. 4*).—Of several plum varieties tested at the California Experiment Station as pollinizers for President, a late-ripening, good-

shipping plum, Sugar and French were found outstandingly favorable. The very small percentage of set obtained by self-pollination showed the President to be practically self-unfruitful.

[Spray schedules for New Jersey fruits] (*New Jersey Stas. Circs. 227 (1931), pp. 7; 228, pp. 4*).—Entitled, respectively, 1931 Spraying Recommendations for Apples and 1931 Spray Schedule for Plums and Cherries, these pamphlets offer concise recommendations for the control of various pests.

The culture of the orange and allied fruits, H. C. POWELL (*[Johannesburg]: So. Africa Cent. News Agency, 1930, pp. 355, pls. 85*).—A general discussion of citrus growing, with particular reference to South Africa.

FORESTRY

Marketing woodland products in Virginia, J. E. LODEWICK (*Virginia Sta. Bul. 276 (1930), pp. 69, figs. 24*).—Based on detailed surveys conducted in seven representative sections of the State and upon other sources of information there is presented a general discussion of existing methods of handling and of marketing of various forest products. Data are presented upon the specifications for various materials used by certain industries, on prevailing prices, price trends and factors influencing them, upon present purchasing and selling methods, market channels for each product, present and future markets, brokerage and commercial fees, transportation costs, etc.

Lumber production and wood utilization in southeastern Minnesota, with special reference to the farm woodlot, L. W. REES (*Minnesota Sta. Bul. 271 (1930), pp. 28 fig. 1*).—Stating that about 25 per cent of the land area in southeastern Minnesota is in woodland and that many of the woodlots have become unproductive through improper management, the author presents data on the kinds and amounts of material sawed from the woodlots of the region, the present disposition of the products, and the kinds and source of supply of raw materials used by the woodworking industries of the area. A summary is presented of present methods of lumber production and marketing. Much of the timber is sold standing to contractors, often with little profit to the owner and with severe injury to the welfare of the woodlot. The author suggests that owners would profit from cooperative marketing. Detailed information is presented on the annual consumption of different species of lumber, on the various products manufactured, and specifications of lumber used by various manufacturers. The general suggestion is made that much more of the lumber used in this region might be produced in the farm woodlots.

The distribution and the mechanical properties of Alaska woods, L. J. MARKWARDT (*U. S. Dept. Agr., Tech. Bul. 226 (1931), pp. 80, pls. 9, figs. 7*).—In this general discussion the author points out that the Alaskan forests are distinctly divided into the forests of the interior covering approximately 50,000,000 acres and the coastal forests covering 21,347,000 acres. The interior forests are of the woodland type, slow in growth, and scattering in stand, whereas the coastal forests are of luxuriant growth and of great commercial importance. The cut in 1929 from the Chugach and Tongass National Forests, which comprise most of the coastal forests, amounted to 47,462,000 bd. ft.

Data presented on the results of strength tests of Alaska species as compared with important species of the United States proper showed that Alaskan woods were fully equal in strength to comparable species grown elsewhere. Western hemlock, Sitka spruce, and other Alaskan species, when properly graded may be used for structural purposes. For mine timber Alaska white birch, western hemlock, white spruce, and Sitka spruce compared very favorably with the best Rocky Mountain softwoods and exceeded in strength many of the species

Possessing large areas suitable chiefly for timber growth, a present utilization far below the potential annual output, a wide range of species, and an abundance of water power, Alaska may look forward to an increasing economic development of its forests, and especially for pulpwood.

Stumpage and log prices for the calendar year 1928, compiled by H. B. Steer (*U. S. Dept. Agr., Statis. Bul. 32 (1931), pp. 26*).—Tables included show prices per 1,000 ft. and range of prices of hardwood and softwood stumpage and logs, by species and States.

DISEASES OF PLANTS

Studies on the life history of the crowngall organism, W. M. Banfield (*Phytopathology, 18 (1928), No. 1, pp. 128, 129*).—During studies still in progress of various phases of the life history of *Bacterium tumefaciens* in relation to raspberry crown gall, the pathogene has been found abundantly in tissue removed aseptically from the interior of crown galls. Masses of bacteria have been observed on the surfaces of the galls, and numbers have been obtained from water in which the galls have been placed. It thus appears that crown galls may continually supply inoculum to the surrounding medium. The pathogene lives in several types of unsterilized soil for a few months to over a year, overwintering thus at Madison, Wis. Wounds are important avenues of entrance. Growth characters of certain raspberry varieties, as well as insects, may be important factors in infection.

Rumex crispus, a weed host of Pseudomonas tumefaciens, J. H. Muncie (*Phytopathology, 18 (1928), No. 1, p. 130*).—Isolations were made from a plant of *R. crispus* taken in June, 1926, by O. H. Elmer from a field of raspberries in Minnesota, some plants of which showed crown gall, and from this *P. tumefaciens* was recovered in almost pure culture. Inoculations into healthy young tomato plants gave typical crown galls. Further inoculations into *R. crispus* with strains of *P. tumefaciens* from Rumex and raspberry resulted in the formation of galls in all cases. This first known occurrence of crown gall on *Rumex* sp. suggested the possible agency of perennial weeds in carrying crown gall.

Studies on crown gall transplants, M. Levine (*Phytopathology, 18 (1928), No. 1, p. 130*).—Pieces of crown gall tissue of *Ricinus communis*, transplanted into Ricinus plants, usually produced small crown galls. Ricinus crown gall tissues produced galls also when transplanted to growing tobacco tissue. Like results were obtained with tomato, geranium, and beet, the neoplasms generally being of the host type. Tomato or Ricinus crown gall inoculated into tobacco induces a differentiated crown gall, showing leafy shoots with characteristic tobacco leaves.

Small, maroon-colored pieces of sugar beet crown gall transplanted to the yellow mangel produced, rather numerously, yellow pigmented crown galls. Growth of the inoculum was observed indisputably in a few instances only. Gross sections of the tumor show distinct proliferations of the host.

These studies are held to show that the crown galls are formed not from the growth of transplanted tissue itself but from the introduction with it of *Bacterium tumefaciens*, which was yielded by plate cultures as revealed by cultural studies, smears, and subsequent inoculations.

Leafhopper injury of legumes, J. Monteith, jr. (*Phytopathology, 18 (1928), No. 1, pp. 137, 138*).—Injury, supposed not to be due to a factor of the virus class but apparently caused by something more than the mere mechanical injuries due to penetration and sucking, and striking differences as regards varietal

susceptibility are reported from work with the potato leafhopper (*Empoasca fabae*) on legumes at the Arlington Experiment Farm in Virginia. The lesser degrees of injury are thought to be due to some host quality rendering the plant less favorable for the feeding and reproduction of the leafhoppers.

Mercury as a control for turf diseases, J. MONTEITH, JR., and A. S. DAHL (*Phytopathology, 18 (1928), No. 1, p. 137*).—Additional work (E. S. R., 58, pp. 546, 747; 59, p. 339) on brown patch gave results supporting those previously announced. The numerous organic and inorganic mercury compounds (the sulfide excluded) proved effective against the two forms of brown patch, their effectiveness depending chiefly on the mercury content. Metallic mercury with chalk appears fully effective. No injury comparable to that caused by copper was observed. The mercury compounds prevent brown patch during weeks or months. Heavy calomel treatment on August 31, 1926, prevented small brown patch until the following August. Corrosive sublimate applied in October, 1926, at Madison, Wis., likewise prevented attacks of snow mold during February and March, 1927. Mercury (calomel) was found again to give the longest protection and to be the least likely to burn, but was slower in checking active brown patch. Mercury compounds may be combined with the ordinary fertilizers used on greens without impairing the fungicidal or fertilizing properties.

The effect of disinfectants upon the germination of seeds kept in storage for indefinite periods after treatment, C. R. ORTON (*Phytopathology, 18 (1928), No. 1, p. 136*).—Seed of varieties of wheat, oats, sweet corn, field corn, and beans, treated with liquid and dust chemical disinfectants at various dates from November, 1924, to November, 1926, and stored at from 20 to 22° C. (68 to 71.6° F.), was germinated October, 1927, in greenhouse soil. Comparisons were made with the germination of untreated seed from the same source and with the germination of the same lots of treated and untreated seed at the approximate date of treatment.

The organic mercury dust did not decrease germination and often increased it after periods of from one to three years. Copper carbonate dusts were injurious on navy and Black Valentine beans. Dusts made up of mercuric chloride and copper oxide decreased germination in some cases. Liquid treatments with organic and inorganic mercuries and water seemed more likely to be injurious, water being especially so. Formaldehyde was especially injurious to oats.

Irrigation as a cause of white spot of alfalfa, B. L. RICHARDS (*Phytopathology, 18 (1928), No. 1, pp. 136, 137*).—White spot is frequently a serious adverse factor in alfalfa production in Utah. Though no experimental data have yet cleared up the obscure nature and causation of this disease, studies indicate that it is in some way associated with an unbalanced water relationship in the plant which may be brought about readily by the mode of application of irrigation water. This was shown and confirmed experimentally in 1926 and 1927, when white spot was induced in from 75 to 80 per cent of the plants in certain fields employed for testing. Heavy rains also cause this disease at times, but it is thought that the improper use of irrigation water is the most important factor in the West.

The production of similar or identical lesions in the leaves of sweetclover (*Melilotus alba*) in the same field and under the same experimental conditions responsible for the white spot of alfalfa indicated that such localized mesophyll destruction is not peculiar to alfalfa.

A bacterial disease of broad beans, A. J. RIKER (*Phytopathology, 18 (1928), No. 1, p. 136*).—During studies made in England of a bacterial disease of broad-

beans, consistent and abundant isolation was obtained of an organism from the so-called chocolate spots, and two strains of this were each for five successive times isolated, inoculated (infection resulting), and reisolated. Typical symptoms developed under certain conditions following inoculations in the greenhouse, and, under circumstances favorable to the organism, the plants lived but three days. The cultures were vigorously pathogenic to garden peas.

The organism grows rapidly on ordinary media. A nonpathogenic organism found in association had the same systematic numbers. Primarily, the organism is intercellular.

Inheritance of resistance to Puccinia sorghi in maize, E. B. Mains (*Phytopathology, 18 (1928), No. 1, p. 138*).—It was found that maize selections of Golden Glow 228, Golden Bantam 996, and Howling Mob 983 are resistant to physiologic form 1 of *P. sorghi* and susceptible to physiologic form 3 in the seedling stage, selections of Golden Glow 208 being resistant to both forms. Studies of the inheritance of resistance have been carried out in a number of crosses with varieties susceptible to both physiologic forms of the rust, and the F_2 ratios mostly approximate three resistant, one susceptible, indicating a single factor in each case. No evidence of linkage was obtained. The same factor is supposedly responsible for the resistance of selections of Golden Glow 208 to both physiologic forms 1 and 3.

Cotton seed treatment by the dusting method, N. C. Woodroof (*Phytopathology, 18 (1928), No. 1, p. 134*).—At the Georgia Experiment Station treating undelinted cottonseed with fungicidal dusts was found to be economical and much simpler than the standard method of delinting with sulfuric acid and soaking for 30 minutes in mercuric chloride. Of the dusts tested several have proved capable of surface sterilizing the seed. Mercuric resinate and a combination mercuric chloride dust are equally as effective as the standard treatment. Angular leaf spot was very much reduced by seed disinfectants, though yields have not been materially increased by any of the treatments.

Outstanding wilt-resistant cotton varieties, D. C. Neal (*Phytopathology, 18 (1928), No. 1, p. 134*).—A list, with sources, is given of staple and short cotton varieties showing considerable wilt resistance during trials in 1926 and 1927 and producing well during those tests.

Resistant varieties and liberal balanced fertilization are regarded as the most feasible and economical means of cotton wilt control.

Cucumber fruit-rot and angular leaf-spot, G. F. Weber (*Phytopathology, 18 (1928), No. 1, p. 133*).—Data from observations in Florida during five years on the occurrence and association of these two diseases, due to *Bacterium lachrymans*, are said to show that the angular leaf spot in the field may or may not be accompanied by fruit rot, but that fruit rot is always accompanied by angular leaf spot. In fields planted with seed treated for 10 minutes with 1:1,000 corrosive sublimate the disease did not develop on leaf or fruit, though it appeared in 75 per cent of fields planted with untreated seed.

Two bacterial organisms isolated respectively from diseased cucumber leaves and fruits near Gainesville, Fla., and used to inoculate cucumber leaves and fruits under controlled conditions, produced both the angular spot on leaves and the fruit rot. The two organisms look very similar in pure culture, and these studies are considered to show that cucumber leaf spot and fruit rot, the discovery of which is accredited to O. F. Burger, are caused by the same organism.

First report of the occurrence of black scab or warty disease of potato in Belgium, E. Marchal (*Phytopathology, 18 (1928), No. 1, p. 136*).—In 1927 potato wart or black scab was found at Stavelot and at Courcelles, affecting

in each case, however, only small holdings of laborers, where potatoes are grown year after year on the same plats for home use.

The gummosis of sugar cane, M. T. Cook (*Phytopathology, 18 (1928), No. 1, p. 135*).—Sugarcane gummosis, a vascular disease due to *Bacterium vascularum*, kills some varieties and reduces the yield more or less in others, though some appear to be immune. Dissolution of cell walls is found to occur but rarely and only in young tissues. The organism is abundant in the parenchyma as well as in the tracheary tubes. At the mills, gummosis lowers purity and interferes with crystallization. The leaf symptoms are unreliable. On plantations the disease is carried mechanically, and in the field it spreads readily from row to row. No insect carriers have been found in Porto Rico.

Sugar cane eye spot in Cuba, J. A. Faris (*Phytopathology, 18 (1928), No. 1, p. 135*).—Of two distinct sugarcane leaf spots due to different Helminthosporiums occurring in Cuba, eyespot, present in western Cuba since 1915, appears to have been reintroduced recently into eastern Cuba from Porto Rico. This spot seriously injures susceptible varieties. D. 109, F. C. 137, F. C. 214, and F. C. 306 are too susceptible for commercial growing, but Badila, Cristalina, Java 105, Java Unknown, and Uba are more resistant. Environmental conditions greatly influence the development of eyespot, the worst effects occurring in localities having high humidity, as in low, foggy valleys. It is stated that this common eyespot, a major disease of sugarcane, has been reported from Hawaii, Fiji, Australia, Taiwan (Formosa), the Philippines, Java, India, Mauritius, Cuba, and Porto Rico, though no evidence of the disease was seen during recent visits to Louisiana and Florida, and it supposedly does not yet occur in the southern United States.

Brown stripe of sugar cane in Cuba, J. A. Faris (*Phytopathology, 18 (1928), No. 1, p. 135*).—Sugarcane brown stripe, caused by *Helminthosporium* sp. differing from that causing eyespot, attacks Cristalina cane throughout Cuba, appearing as minute, reddish spots which elongate to form characteristic linear stripes surrounded by slight halos. Previously considered an immature stage of the eyespot described above, it has been proved that the two diseases are not identical. The two types of spots are distinguishable in their early stages, and the causal fungi also have distinct characteristics in growth on various media and in spore morphology. A similar brown stripe was observed in Louisiana and Florida in the summer of 1927, and it is thought that the causal fungus may be identical with that named *H. stenospilum* by Drechsler (see below). The development of brown stripe seems to be favored by slow growth, its prevalence being most marked during long dry periods in the summer and late winter.

A species of Helminthosporium distinct from Helminthosporium sacchari, causing brown stripe of sugar cane, C. Drechsler (*Phytopathology, 18 (1928), No. 1, pp. 135, 136*).—Leaf injury has been connected with two species of Helminthosporium during the collection over several years of diseased sugarcane specimens. The lesions are described. One of the forms, from lesions of the true eyespot type, is regarded as *H. sacchari*, and the other, associated with brown stripe, is provisionally indicated as the new species *H. stenospilum*.

The effects of lime on cigar tobacco, C. M. Slagg, J. E. Montreuil, and T. G. Major (*Phytopathology, 18 (1928), No. 1, pp. 130, 131*).—The effects on cigar tobacco of air-slaked lime at 2,000 lbs. per acre in combination with manure, with commercial fertilizers, and with commercial fertilizers and manure were studied at the Farnham, Quebec, Experimental Station in 1925, 1926, and 1927. The field used had previously grown tobacco several times in a 3-year rotation of oats, clover, and tobacco. Though the soil was free from Thielavia

at the beginning of this experiment, that fungus was found at the end of that period in moderate quantity. It was most abundant on the limed plats, significant decreases in yield and quantity of tobacco being noted wherever lime was applied during each of the three years of the experiment here reported.

Tobacco ringspot, a virus disease with a wide host range, S. A. WINGARD and F. D. FROMME (*Phytopathology, 18 (1928), No. 1, p. 133*).—Tobacco ring spot proves to be a virus disease capable of attacking plants over a wide range, infections having been obtained on 19 genera in 11 families named. The green aphid may transmit the virus in the greenhouse, but insects are not necessary to transmission, as this is readily accomplished by swabbing trial plants with the expressed sap of diseased plants. The sap proved infectious in dilutions as high as 1:10,000, but not higher.

Effect of timothy infusion of different ages on the growth of tobacco and on brown root rot of tobacco, W. L. DORAN (*Phytopathology, 18 (1928), No. 1, pp. 131, 132*).—Water decoctions of timothy plants, aged from 1 to 3 weeks and applied to soil growing tobacco plants, were not inhibitory to tobacco plants if kept near 27° C. (80.6° F.), nor did they induce brown rot. Such infusions, when from 4 to 10 weeks old, resulted in brown rot symptoms on tobacco, the growth of which was also greatly inhibited. Infusions from 9 to 10 weeks old were less toxic.

In another experiment, timothy decoctions were made with most of the timothy tops removed and were kept near 16°. Such infusons when from 1 to 6 weeks old induced no brown root rot and greatly improved the growth. At from 7 to 12 weeks of age the infusions gave brown root rot symptoms, and when they were from 10 to 12 weeks old the growth was reduced by fully 50 per cent.

Accuracy in comparing various concentrations of tobacco-mosaic virus, F. O. HOLMES (*Phytopathology, 18 (1928), No. 1, p. 132*).—A method is outlined which is said to be so accurate that test dilutions of 1:4 or 1:8 can be identified from undiluted samples of virus with a certainty corresponding to odds of 22 to 1 or more. Similarly adjacent portions of infected plant tissues can be identified and accurate readings made with no more than 1,000 seedlings, and equally accurate comparisons of sources differing even less in strength can be made by using larger numbers of plants.

Experiments and observations on the control of true tobacco mosaic, W. D. VALLEAU and E. M. JOHNSON (*Phytopathology, 18 (1928), No. 1, pp. 132*).—Good to high control of tobacco mosaic in fields was obtained by substituting sterilized for natural-leaf tobacco for use by the men pulling the young plants. This control was increased by the strict observance of cleanliness of the hands while doing this work.

The method and rate of migration of Bacterium tumefaciens in tomato, J. B. HILL (*Phytopathology, 18 (1928), No. 1, p. 129*).—After healthy young tomato stems had been inoculated with *B. tumefaciens*, a study of properly stained paraffin sections begun within three hours showed that the bacterial extensions advance as zoögloeae or zoögloeal strands through the intercellular spaces of the pith and subepidermal chlorophyllose parenchyma. The zoögloeal strands, which have blunt and rounded ends, supposedly consist of a semifluid gelatinous matrix densely packed with bacteria and are strictly continuous for from 0.35 to 0.56 mm., and more or less continuous for much greater distances. Rates of advance among more than 80 zoögloeae as observed and calculated ranged between approximately 0.04 mm. per minute for the first 15 minutes and 0.03 mm. per minute for 3 hours. The maximum migration rate was only

one twenty-fifth of the published calculation of the rate of a single moti B. *tumefaciens* in liquid medium.

Grafting as a further means of preventing callus knots on apple, I. E Melhus, J. H. Muncie, and V. C. Fisk (*Phytopathology, 18 (1928), No. 1, pp 127, 128*).—Conditions causing and following callus-knot formations following grafting are described.

Storage trials were made in which wedge and tongue grafts of Wealthy apples were callused at low, medium, and high temperatures. The wedge grafts gave an average of 75 per cent less callus knots than the tongue grafts. In both cases the majority of the knots developed at the tip of the scion lip.

Studies of the history of development of wound overgrowths on apple grafts and of the influence of wrappers on their suppression, A. J. Riker, W. M. Banfield, and G. W. Keitt (*Phytopathology, 18 (1928), No. 1, pp. 128*).—It is noted that in apple grafts certain enlargements develop early as the result of poor union, though these are controllable through good fitting and wrapping. Enlargements start at or after midseason on any part of the union, the development of which apparently correlates with periods of rapid secondary thickening.

The retention of integrity by the wrappers in the soil is related to the development of wound overgrowths. Studies showed that cotton thread may be so treated chemically as to endure for any period desired. In case of wrappers lasting more than 11 weeks, girdling was caused. Typical wound overgrowths followed girdling. Uneven application lengthened considerably the duration of the wrappers. Of the wrappers used, medical adhesive tape gave the highest percentage of salable trees. Trials during three years in Wisconsin, Minnesota, Nebraska, Missouri, and Oklahoma have consistently shown that grafts wrapped with an adhesive tape produced a considerably higher percentage of salable trees than those wrapped with string.

Correlation of the wound overgrowth and crowngall of apple in parts of Europe and of the United States, A. J. Riker (*Phytopathology, 18 (1928), No. 1, p. 128*).—Results of a survey made in nurseries of England, France, and the Netherlands to correlate the wound overgrowth and crown gall situations there with those in the North-Central and Northeastern United States are briefly described. It is pointed out that this part of Europe has a mild climate (long growing season), that the market requires a high percentage of dwarfed trees, and that practically all fruit trees are propagated by budding. As in America, the practice of budding has practically eliminated wound overgrowths from the plants, except as these developments follow injuries to the stock. Bacterial crown gall, though widely distributed, has economic significance only in a few isolated cases. However, burrknots are very common, owing to the common use of Paradise and Doucin stocks for the growth of more or less dwarfed apple trees. Enlargements at the union several inches above the soil level, attributed to lack of congeniality, were usually present on the dwarfed stock.

Overgrowths and hairy root on nursery apple and quince trees, J. H. Muncie and W. B. Shippy (*Phytopathology, 18 (1928), No. 1, p. 127*).—Isolation tests of 111 grafted apple trees showing hairy knots at the unions failed to give *Pseudomonas tumefaciens*. Similar tests with 58 trees showing fibrous hairy root without an overgrowth yielded the organism from four swollen bases of the hairy roots and from 1 of 100 trees showing the burrknot type of hairy root on the stock, but not from 20 quince trees or from 15 rooted quince cuttings. Typical hairy roots were induced at the nodes of 15 quince cuttings by rooting under aseptic conditions.

In 7 per cent of 2,200 apple seedlings inoculated in the field, galls were produced and isolations from representative specimens were positive.

No pathogene was recovered in any case from the overgrowths with fleshy hairy roots which developed on 0.4 per cent of two lots, each of 2,400 wounded seedlings grown in two plats of field soil noninfested and infested with *P. tumefaciens*. Isolation tests proved negative in the case of seedlings showing either hairy roots or woolly knots.

In isolation studies of burrknots made from specimens of 24 varieties of apple from 4 States, organisms resembling *P. tumefaciens* were found but rarely, and these were not pathogenic to tomato plants.

Field observation records show that, while certain environmental conditions favor development of burrknots, certain varieties never have them. Certain varieties showing no burrknots, when cross-pollinated, produced hybrids bearing at an early age aerial tumors.

The spread of cranberry false blossom in the United States, N. E. Stevens (*U. S. Dept. Agr. Circ. 147 (1931), pp. 19, figs. 2*).—False-blossom disease, known to be transmitted readily by the leafhopper *Euscelis striatulus*, but to the present extent of knowledge by no other insect, was found in all but the most isolated cranberry-growing districts. A survey of the general situation showed an increasingly rapid spread of the disease in Massachusetts and New Jersey during the last decade. In Wisconsin, where the disease is believed to have first appeared, there was evidence of consistent spreading. Very slow spread in Washington and Oregon, in which area the disease was introduced several times in 1912 and 1914, is thought to be due to the absence of the insect carrier.

Considerable variation was noted in the susceptibility of cranberry varieties to the disease, Howes, Searls, or Pride being highly susceptible. The tendency to plant susceptible varieties is deemed a factor in the increasing rate of spread of the disease. The greater use of fertilizer and improved cultural operations, which in turn promote vine growth and offer a more favorable environment for the leafhopper, are also considered factors. Changing the time of summer flooding of bogs is believed to have favored the leafhopper, since in Massachusetts growers who have delayed June flooding have had the least rapid increase in the false-blossom disease.

The effective methods of eradicating Rhamnus species susceptible to Puccinia coronata Corda, S. M. Dietz and L. D. Leach (*Phytopathology, 18 (1928), No. 1, p. 138*).—*R. cathartica* and *R. lanceolata* are said to have initiated local epidemics of crown rust (*P. coronata*) in the upper Mississippi Valley during 11 of the previous 12 years. Effective methods of eradication of *R. lanceolata*, as tabulated, include the application of salt to the base of the harboring plant, a like application of kerosene, an application of salt following the removal of the top growth, and removal of the crown. The response of *R. cathartica* to salt and removal of the crown was similar to that of *R. lanceolata*. Seasonal effect was rather marked. Bushes salted in March died in about 66 days, those salted in July in 98 days, and those salted in August within 162 days. Bushes kerosened in March died in 110 days, those treated in July in 77 days, and those treated in August in 109 days.

ECONOMIC ZOOLOGY—ENTOMOLOGY

Habits and economic status of the pocket gophers, T. H. Scheffer (*U. S. Dept. Agr., Tech. Bul. 224 (1931), pp. 27, pls. 8, figs. 2*).—This report of studies of the pocket gophers, which are widely distributed in the United States and

are a source of damage to various agricultural crops, deals with their geographical distribution and classification; presents a description of them and their habits; gives accounts of their food, natural enemies, damage to agricultural crops, including alfalfa and the clovers, natural-grass meadows, root crops, horticultural crops, irrigated lands and crops, and pasture and range; and recommends control measures. A list is given of 30 references to the literature.

Local bird refuges, W. L. McAtee (*U. S. Dept. Agr., Farmers' Bul. 1644 (1931), pp. II+14, figs. 4*).—This publication, which is one of a series describing the best methods of attracting birds, supersedes Farmers' Bulletin 1239, previously noted (E. S. R., 46, p. 456).

[Scientific notes on economic insects and insecticides] (*Jour. Econ. Ent., 24 (1931), No. 1, pp. 325–332*).—The notes here presented are as follows: An Overlooked Suggestion regarding Possible Practical Use of Parasites, by L. O. Howard (pp. 325, 326); Chinese Vitex Introduced into Haiti, by H. L. Dozier (p. 326); Tarnished Plant Bug Injury to Beans, by W. E. Shull and C. Wakeland (pp. 326, 327); Removal of Leafhopper Specking from Apples, by W. S. Hough (p. 327); Tomato Vines Injured by a Mirid (*Engytatus geniculatus* Reuter), by W. W. Jones (pp. 327, 328); Tests with Paradichlorobenzene-Oil Emulsion against the San Jose Scale, by O. I. Snapp and J. R. Thomson (pp. 328, 329); Genuine Derris Root May Contain No Rotenone, by R. C. Roark (pp. 328, 330); Length of the Developmental Stages of the Horn-Fly, *Haematobia irritans* (Linne), at Constant Temperature, by R. Melvin and D. E. Beck (pp. 330, 331); and The Papaya Fruit Fly [*Toxytrypana curvicauda* Gerst.] in Puerto Rico, by M. D. Leonard and F. Sein, jr. (pp. 331, 332).

Insecticide investigations during 1930, E. P. Felt and S. W. Bromley (*Jour. Econ. Ent., 24 (1931), No. 1, pp. 232–240*).—Insecticide investigations conducted by the authors during the year 1930 are summarized as follows:

"Molasses nicotine soap sprays, which have proven effective in the control of certain delicate insects, were applied with safety to a series of 13 species of trees at a molasses dilution of 1–20. Tulip and gray birch showed slight injury at this dilution. Due to the dry seasons of the past two years, the chinch bug, *Blissus leucopterus* Say, became a serious lawn pest in certain localities. A series of sprays and dusts were tested for its control, with potassium oleate plus nicotine appearing the most promising. A series of sprays were tested for the control of the rhododendron lace bug, *Stephanitis rhododendri* How., with results indicating the value of the spray when there was a thorough wetting of the insect. Dormant oil sprays were demonstrated as effectively controlling oak leaf rollers, *Argyrotoxa semipurpurana* Kf., by killing the overwintering eggs. The tuliptree scale, *Toumeyella liriodendri* Gmel., was effectively controlled by certain dormant oil sprays, but only partial controls were obtained after foliation had taken place and the scale had advanced in growth and resistance. Field tests with dormant oils on sugar maples and black walnut demonstrated the injurious effects of such sprays on these trees. Spray injury tests with oil and lime sulfur on foliage of various trees revealed a certain type of injury characteristic of this combination, while combinations of soap and arsenate of lead on conifers also produced a characteristic type of injury."

Hints at new spray procedures, P. J. Parrott, F. Z. Hartzell, H. Glasgow, and S. W. Harman (*Jour. Econ. Ent., 24 (1931), No. 1, pp. 297–302*).—This is a report of investigations at the New York State Experiment Station conducted with a view to finding materials or practices that will improve the present methods of control of the rosy aphids and bud moth.

"Three methods have been tested, viz, (1) autumn defoliation, (2) fall spraying, and (3) winter treatment. Sodium nitrate proved the best material for rendering the trees unattractive to the rosy aphid, and apparently is safe to the twigs. None of the defoliation materials controlled bud moth. Fall spraying with nicotine or ground tobacco killed the fall migrants and the egg-laying females of the rosy aphid, but the utility of this means of control remains to be determined. Winter treatments with tar distillate sprays were very effective against apple aphid eggs and the nymphs of the spruce gall aphid, but proved ineffective against the eggs of the leaf roller. These washes appear to be safe to the trees. As regards rosy aphid, these methods of treatment, if successful, may prove of value in that the period of spraying could possibly be extended."

What summer oil sprays may do to apple trees, J. M. Ginsburg (*Jour. Econ. Ent., 24 (1931), No. 1, pp. 283–290, pls. 2*).—The results of summer oil spraying during the past three years on large blocks of apple trees at the New Jersey Experiment Stations have shown that continuous application of oil emulsions during the growing season may bring about physiological changes in growth processes and fruit production. More injury to foliage resulted from early sprays, applied during May and June, than from late sprays, applied during July and August. Of the various vegetable and animal oils tested, sperm oil proved to be the least injurious to apple and peach foliage.

The effect of soap on the toxicity of a pyrethrum product known as "Red Arrow," A. E. Badertscher (*Jour. Econ. Ent., 24 (1931), No. 1, pp. 268–277, figs. 3*).—The results of tests conducted at the New Jersey Experiment Stations in which the green spirea aphid (***Aphis spiraecola*** Patch) was used in determining the toxicity of Red Arrow in varying concentrations, of potassium coconut fatty acid soap at varying concentrations, and of mixtures of Red Arrow and additional soap with Red Arrow variable and soap constant and with soap variable and Red Arrow constant are reported. They indicate that Red Arrow diluted with tap water does not function at its maximum efficiency, probably because the surface tension of the aqueous carrier is too high to permit sufficient penetration into the internal tissues of the insect through the breathing system. This study further indicates that the efficiency of Red Arrow is increased almost four times when diluted with water containing enough soap (0.4 per cent) to condition the aqueous carrier to very nearly 30 dynes.

"A study of the relative toxicity of samples of Red Arrow manufactured in 1927, 1928, 1929, and 1930, respectively, kept under normal storage conditions, and tested October, 1930, on honeybees (***Apis mellifera*** Linn.) and on the black bean plant louse (***Aphis rumicis*** Linn.) . . . shows that the various samples of Red Arrow tested have lost very little if any of their toxicity."

The incompatibility of lime with fluosilicates, R. H. Carter (*Jour. Econ. Ent., 24 (1931), No. 1, pp. 263–268, fig. 1*).—The author has found that the addition of small amounts of lime materially decreased the solubility of fluosilicates, probably due to the introduction of a common ion from the reactions. Strongly alkaline solutions were formed when an excess of lime was present, due to further reactions.

Preparations containing rotenone for use as insecticides.—I. Aqueous suspensions, H. A. Jones and W. M. Davidson (*Jour. Econ. Ent., 24 (1931), No. 1, pp. 244–257*).—"Aqueous suspensions of rotenone were prepared by two general methods, namely, the addition of rotenone solutions in water miscible solvents to water and the mixing of powdered preparations of rotenone with water. Numerous solvents and protective colloids were tested. Permanent suspensions containing 0.05 to 0.5 gm. of rotenone per liter and having the

rotenone in a highly dispersed condition were obtained by the addition of pyridine solutions and acetone solutions containing tannic acid to water. Mixtures of certain dry protective materials with precipitated rotenone also gave satisfactory suspensions when first made into a paste with water and then diluted to the desired concentration. Permanent suspensions of rotenone were more readily obtainable in slightly alkaline conditions. It was found difficult to obtain lasting suspensions in hard water."

Change in toxicity of rotenone in solution and suspension, W. M. DAVIDSON and H. A. JONES (*Jour. Econ. Ent., 24 (1931), No. 1, pp. 257–262*).—The authors found rotenone to decompose at various rates when allowed to stand in solution in certain solvents, the decomposition being evidenced by development of a yellow color and in some cases by separation of certain of the yellow decomposition materials in crystalline form. "This change is accompanied by a loss in toxicity to insects, as shown by entomological tests made with aqueous suspensions prepared from these solutions. The loss in toxicity occurs most rapidly in pyridine, less rapidly in acetone containing tannic acid, and is imperceptible in both acetone and alcohol. The yellow decomposition products separating from pyridine solutions were found to have much less insecticidal activity than pure rotenone. The aqueous suspensions prepared from acetone and alcohol solutions of rotenone showed only a slight loss in toxicity on standing. Dry rotenone shows no decomposition or loss in toxicity."

Triethanolamine emulsions, A. L. WILSON (*Indus. and Engin. Chem., 22 (1930), No. 2, pp. 143–146*).—The author reports that the new commercial material triethanolamine, $N(C_2H_4OH)_3$, is well suited for emulsification purposes. It has a number of advantages over the usual inorganic bases used for this purpose. A new method of emulsification with this product, which is applicable to the emulsion of any type of material, is described. The use of triethanolamine as a basic material for soaps and for the emulsification of soluble mineral oils, vegetable and animal oils, waxes, and various solvents is discussed.

Experiments in spray residue removal, L. R. STREETER, P. J. CHAPMAN, and G. W. PEARCE (*Jour. Econ. Ent., 24 (1931), No. 1, pp. 240–244*).—This contribution from the New York State Experiment Station reports on preliminary tests of commercial methods of removing apple spray residues in New York. Acid-insoluble spray residues (especially sulfur), road dust, and spotting from the leafhopper *Typhlocyba pomaria* are also considered.

Insect enemies of the sugar beet, C. MENOZZI (*Insetti Dannosi alla Barbabietola. Genoa: Soc. Ent. Ital., 1930, pp. 98, pls. 4, figs. 26*).—A preliminary account of observations in Italy.

Codling moth and peach worm investigations.—Progress report, H. J. REED (*Indiana Sta. Circ. 179 (1931), pp. 8, figs. 5*).—This progress report includes recommendations regarding control of the codling moth based upon work of the past two years on (1) packing house sanitation, (2) orchard sanitation, (3) spraying, (4) banding, and (5) baits. In hibernation studies and sanitation work with the oriental fruit moth it was found that 7 per cent of the larvae hibernate below the snow line on the ground and 93 per cent above. It has also been determined that 80 per cent of all spring emergence during the last two years came from below the snow line out of weed stems from around the base of the tree and from mummied peaches on the ground. For this reason, thorough sanitation and early spring cultivation are recommended.

The snowy tree cricket and other insects injurious to raspberries, L. M. SMITH (*California Sta. Bul. 505 (1930), pp. 38, figs. 16*).—The first part of this bulletin (pp. 3–24) deals with the snowy tree cricket, an account of its life history being followed by a report of experiments on control, many of the

details of which are presented in tabular form. The four species of hymenopterous egg parasites, *Macrorileya oecanthi* Ashm., *Caecilus oecanthi* Ashm., *Eupelmus* sp., and *Aprostocetus* sp., are the most effective natural checks, the first mentioned being the largest and most important. The insecticide work has shown that the pest is best controlled by a dust composed of 70 per cent of sodium fluosilicate and 30 per cent of diatomaceous earth, applied at the rate of about 50 lbs. to the acre with a rotary fan blower. In the application of this treatment, the cost of which is from $8 to $12 per acre, the operator should walk down the row, directing the dust into the upper third of the bushes, it being necessary to dust only one side of a row. The dust should be applied in the intercrop period, and no berries should be picked for 10 days after dusting. It is pointed out that the dust should not be applied in the early morning or evening, or at any time when the berries are wet, since injury may result under these conditions. If properly carried out, the control work need not be repeated the following year, but it may be necessary in the second or third year following.

Accounts then follow of the black vine weevil (*Brachyrhinus sulcatus* Fab.), for which the apple-pulp poison bait proved most effective; the rough strawberry weevil (*B. rugosostriatus* Goeze); the *quadrinotata* variety of the strawberry rootworm; the strawberry crown moth (*Synanthedon bibionipennis* Bdv.); the raspberry root borer; the red spider (*Tetranychus telarius* (L.)); the blue sharpshooter (*Cicadella circellata* (Bak.)); Fuller's rose beetle; the raspberry horntail (*Hartigia cressoni* (Kirby)); and the California tree cricket (*Oecanthus californicus* (Sauss.)). Particular attention is given to the first two of these.

Insects affecting coffee in Kona, Hawaii, D. L. Crawford (*Hawaii Univ. Agr. Ext. Bul. 9 (1931), pp. 17, figs. 10*).—A practical account.

Some shade-tree pests and their control, G. W. Herrick (*New York Cornell Sta. Bul. 515 (1931), pp. 26, figs. 18*).—Brief summarized accounts are given of studies of four of the little-known but common troublesome pests of shade trees, namely, the pine leaf scale (*Chionaspis pinifoliae* Fitch) (pp. 3–11), the magnolia scale (pp. 11–16), the maple bladder gall mite (*Phyllocoptes quadripedes* Shimer) (pp. 16–21), and the spruce gall aphid (*Adelges abietis* L.) (pp. 21–23), particularly as relates to means for their control.

It was found that the pine leaf scale can be effectively controlled in central New York by spraying the infested trees during the first week in July with a miscible oil to which soap and nicotine sulfate have been added. The magnolia scale can be treated economically and effectively by spraying the infested trees or shrubs during April before the buds burst with a miscible oil. It is pointed out that infested magnolia shrubs of moderate size may also be freed from the scales by brushing them off by hand in July after the female scales have become large and conspicuous. The experiments have shown that the maple bladder gall can be controlled by applications of lime sulfur made in the spring before the buds start. Investigations extending over several years have demonstrated that the spruce gall aphid can be controlled by spraying infested spruces in April with lime sulfur, miscible oils, or with nicotine sulfate and soap.

Common insects of the household, G. W. Herrick and G. H. Griswold (*N. Y. Agr. Col. (Cornell) Ext. Bul. 202 (1931), pp. 53, figs. [52]*).—A practical account.

Spined soldier-bug reared on celery leaf tyer, D. Stoner (*Fla. Ent., 14 (1930), No. 2, pp. 21, 22*).—The author's observations of the feeding of the spined soldier bug on the celery or greenhouse leaf tyer, here reported, indicate that this pentatomid may breed throughout the year in central Florida. While

it is not of frequent occurrence on celery in the Sanford district, it may, i present, be of value in destroying this pest.

Winter spraying for the control of the apple capsid bug, F. R. Petherbridge and G. L. Hey (*Jour. Min. Agr.* [*Gt. Brit.*], *37* (*1931*), *No. 11, pp. 1078-1087*).—A report of control work with *Plesiocoris rugicollis* in which fou experiments are reported.

A revision of the American species of Empoasca known to occur north of Mexico, D. M. DeLong (*U. S. Dept. Agr., Tech. Bul. 231* (*1931*), *pp. 60, figs 11*).—Following a brief introduction, the author deals with the economic problem and its relation to taxonomy; geographical distribution; historical résumé; the genus and its position; external structural characters; characters used in classification; technic and method of study; classification of the species of Empoasca, including a key to the subgenera of Empoasca, namely, Kybos Fieber, Hebata—here erected, Empoasca Walsh, and Idona—here erected; a list of described species with synonyms; and species not included in this revision. Of the 51 species recognized by the author, 27 are here described as new. A list of 28 references to the literature is included.

Leafhopper studies during 1930, W. J. Schoene (*Jour. Econ. Ent.*, *24* (*1931*), *No. 1, pp. 177-180, fig. 1*).—At the Virginia Experiment Station, where the effect of severe drought on apple leafhoppers was observed, the three species of Erythroneura were practically absent during the early summer, 1930, but gradually increased in numbers as the season advanced. The severe drought shortened the life of *Typhlocyba pomaria* first brood adults in some sections, and the second brood did not develop into injurious numbers.

Some studies on the larval parasites of the oriental peach moth (Laspeyresia molesta Busck), B. F. Driggers (*New Jersey Stas. Bul. 510* (*1930*), *pp. 19, figs. 6*).—This is a report of the results of studies conducted over a period of 4 years in New Jersey in continuation of those inaugurated by Stearns in 1925 and continued and expanded in 1926, as previously reported (E. S. R., 57, p. 756; 60, p. 62). The work is considered under the headings of comparative parasitism in 1927, including parasitism of larvae from peach twigs and peach fruit; comparative parasitism in 1928, 1929, and 1930; parasitism over a period of years, including extent of all parasites, of *Macrocentrus ancylivora* Roh., *M. delicatus* Cress., *Glypta rufiscutellaris* Cress., and of lesser larval parasites; and practical application of the data obtained.

The studies conducted during the 6-year period show that a large percentage of the larvae succumb to parasitic attack. "A general increase in the effectiveness of the parasites was noticeable except in the fifth year (1929), when a falling off was apparent. In the one season of study the larvae collected from the fruit were attacked by the same group of parasites as were found parasitizing larvae feeding in the twigs. Many of the larvae taken from the fruit were parasitized, particularly those taken in the fore part and middle of the season. It is believed that a considerable part of this parasitism took place while the larvae were feeding in twigs before their transfer to the fruit.

"Certain species of parasites were effective in one section of the State but were of minor importance elsewhere. As an example, *G. rufiscutellaris* in north Jersey and *M. ancylivora* in south Jersey may be cited. Data are presented which show that *G. rufiscutellaris* had a period of increase followed by a decline. The decline was coincident with, and is believed to be due to, a high degree of hyperparasitism. The data also show that several of the parasites that were of minor importance at first increased in effectiveness until they stood first or second in importance. This was particularly noticeable in the case of *M. delicatus* and *Pristomerus ocellatus* [Cush.] in north Jersey.

M. ancylivora started as the most important parasite in south Jersey and retained that position throughout the period.

"Experiments were carried out in the rearing and liberation of Macrocentrus and Glypta in the section of the State where each of these parasites was not normally very effective. No appreciable increase in parasitism was obtained in the Glypta liberations. A considerable increase in parasitism was obtained in the two seasons' liberation experiments with Macrocentrus. The results indicate that there is a possibility of using Macrocentrus to advantage by introducing and liberating it in sections where it is slow in building up or where it is apparently not present naturally."

Experiments with white oil-pyrethrum for the control of the oriental peach moth, B. F. Driggers (*Jour. Econ. Ent., 24 (1931), No. 1, pp. 319–325*).—Laboratory experiments at the New Jersey Experiment Stations with white oil-pyrethrum sprayed on new and old peach twigs showed that newly hatched oriental fruit moth larvae were killed more easily when they crawled over sprayed new growth than over sprayed old growth. "The difference appeared to be due to the greater absorptive power of the old growth for the oil.

"Field spraying tests in which white oil-pyrethrum was used at 0.5 and 1 per cent on a 5-day schedule against third brood eggs and larvae showed a reduction in invisible fruit infestation of from 60 to 75. Visible fruit infestation, which was comparatively high at the time the spraying operations were begun, was reduced much less by the spray, so that the combined visible and invisible injury gave a total reduction in fruit infestation of from 30 to 70 per cent. The effect of parasites on the seasonal activities of the peach moth and their relation to spraying operations are discussed."

Performance of the thermal constant as an indicator of the time to apply cover sprays for codling moth, T. J. Headlee (*Jour. Econ. Ent., 24 (1931), No. 1, pp. 291–296*).—The author reports that the thermal constant has been used at the New Jersey Experiment Stations for a period of three years, 1928, 1929, and 1930, for practical determination of the time when cover spraying should start for the first and for the second broods of codling moth, and has seemed to be eminently successful for that purpose. "It seems likely that the thermal constant can be used as a satisfactory practical determinator of the length of periods during which spray coatings must be maintained on fruit and foliage against entry by larvae of the first and of the second broods. When the average weekly minimum temperatures reach about 60° F. pupation of summer larvae seems to cease, and it is thought that these minimum temperatures are probably the agency limiting the number of codling moth broods."

Comparative performance of nicotine tannate and lead arsenate against the codling moth, R. S. Filmer (*Jour. Econ. Ent., 24 (1931), No. 1, pp. 277–283*).—The results of the season's field tests with nicotine tannate by the New Jersey Experiment Stations are here reported. When a sufficient coating of nicotine tannate is maintained upon the foliage during the period of codling moth activity, it controls the codling moth as well as lead arsenate.

Oriental peach moth experiments, D. M. Daniel (*Jour. Econ. Ent., 24 (1931), No. 1, pp. 317, 318*).—In this contribution from the New York State Experiment Station the results are given of the season's experiments with 20 insecticides used in combating the oriental fruit moth, partial reduction of such infestation having been secured in all cases. A report of the third season's work in colonizing the parasite *Macrocentrus ancylivora* Roh. (E. S. R., 63, p. 461) is included. The area previously colonized showed a parasitism of 54.54 per cent, a 390 per cent increase over that of the preceding year.

Some habits of the adults of the oriental fruit moth with reference to baits, S. W. Frost (*Jour. Econ. Ent., 24 (1931), No. 1, pp. 302–309, figs. 3*).—Studies conducted at the Pennsylvania Experiment Station with adults of the oriental fruit moth are presented under the headings of moth population of a tree, distribution of moths determined by clipping infested terminals, distribution of moths determined by bait traps, and moth releases. The paper, which is a continuation of work in 1929, previously noted (E. S. R., 64, p. 460), emphasizes the fact that there is a decided need for further knowledge of the habits of the adults of the oriental fruit moth, as well as of those of the larvae and pupae.

Oriental fruit moth parasite work in Connecticut in 1930, P. Garman (*Jour. Econ. Ent., 24 (1931), No. 1, pp. 315, 316*).—A brief account of the work under way in Connecticut in 1930.

Influence of planting dates of sweet corn on European corn borer infestation, G. E. R. Hervey and F. Z. Hartzell (*Jour. Econ. Ent., 24 (1931), No. 1, pp. 183–188, fig. 1*).—The methods followed and results obtained by the New York State Experiment Station are given for experiments dealing with the time of planting sweet corn in relation to European corn borer infestation in central and western New York. The Latin square arrangement of plats was used with five planting dates and five replications. The results obtained indicate that the time of planting has an important influence on the corn borer infestation.

European corn borer control.—Progress report, H. J. Reed (*Indiana Sta. Circ. 178 (1931), pp. 12, figs. 10*).—A brief discussion of the progress of work with the European corn borer in Indiana, where it has spread from 39 townships in 1926 to 303 townships in 1930. During the season of 1930 the extremely hot and dry weather at the critical stages in the life history of the insect prevented it from making its normal increase during the past year.

Algeria: Pink bollworm of cotton (*Internatl. Bul. Plant Protect. [Rome], 4 (1930), No. 12, p. 177; 5 (1931), No. 1, pp. 4, 5*).—A note on the pink bollworm of cotton in Algeria, where it was found at Perrégaux in March, 1930, and now occurs in all the cotton-growing regions.

The brown cutworm (Euxoa radians Guen.).—Part V, Oecological discussion, G. A. Currie (*Queensland Agr. Jour., 35 (1931), No. 1, pp. 18–33, pl. 1, figs. 4*).—This continuation of the account previously noted (E. S. R., 64, p. 461) consists of an ecological discussion, presented in connection with graphs; a summary of knowledge of the pest; and an appendix consisting of notes on some attacks by other noctuid caterpillars in Queensland in the 1928–29 season, including the black cutworm, *Spodoptera mauritia* Boisd., and *Remigia frugalis* Fab.

The pear midge, F. G. Mundinger (*Jour. Econ. Ent., 24 (1931), No. 1, pp. 196–200, fig. 1*).—Studies at the New York State Experiment Station indicate that the adults of the pear midge are very susceptible to certain spray treatments, and that these are most efficiently made when the cluster buds have begun to swell so that the sepals pull apart.

Horse nose flies can be controlled, F. D. Butcher and K. W. Stouder (*Iowa Agr. Col. Ext. Bul. 167 (1930), pp. [4], figs. 6*).—A practical account.

Surra in Mauritius, and Stomoxys nigra, its principal vector [trans. title], A. Moutia (*Dépt. Agr. Ile Maurice, Sér. Sci., Bul. 12 (1929), pp. 12*).—This is a report of studies of the only biting fly of common occurrence in the island of Mauritius and which transmits the surra trypanosome. Direct transmission takes place from 1 to 10 minutes after ingestion of blood containing the trypanosome when the temperature is from 25 to 27° C.

The fruit flies of New York, F. L. Gambrell (*Jour. Econ. Ent., 24 (1931), No. 1, pp. 226–232, pl. 1, figs. 2*).—This contribution from the New York State

Experiment Station records the cherry fruit flies, *Rhagoletis cingulata* (officially known as the cherry fruit fly) and *R. fausta;* the apple maggot; the walnut husk maggot (*R. suavis*); and the currant fruit fly. Certain points relative to the distribution, abundance, life history, and control of these species are discussed.

The present status of carrot rust fly control in New York, H. Glasgow (*Jour. Econ. Ent., 24 (1931), No. 1, pp. 189–196, pls. 2*).—Reporting upon the work with the carrot rust fly at the New York State Experiment Station, it is pointed out that injury may be prevented or greatly reduced by regulating the planting and harvesting dates so that the growing period falls in the interval between the first and second broods of the insect. The maggot-free period may be further extended by repeated applications of naphthalene, commencing when the flies of the second generation begin to appear and continuing to approximately one month of the proposed harvesting date.

A monograph of Egyptian Diptera, I-III, H. C. Efflatoun (*Mém. Soc. Ent. Égypte, 2 (1922), No. 1, pp. 123, pls. 6; Mém. Soc. Roy. Ent. Égypte, 2 (1924), No. 2, pp. 132, pls. 5, figs. 3; 4 (1930), No. 1, pp. 114, pls. 2, figs. 128*).—Part 1 of this work deals with the family Syrphidae, part 2 with the family Trypaneidae, and part 3 with the family Tabanidae.

A manual of the genera of beetles of America north of Mexico, J. C. Bradley (*Ithaca, N. Y.: Daw, Illston & Co., 1930, pp. X + [1]+360; rev. in Ent. News, 42 (1931), No. 3, pp. 88–90*).—This work includes dichotomous keys for the determination of the families and subfamilies of Coleoptera known to occur in America north of Mexico, keys to the tribes and genera of each family, a taxonomic conspectus of the genera (pp. 306–334), and an index (pp. 335–360). The classification used in the work is essentially that of Leng's catalogue of Coleoptera (E. S. R., 44, p. 657). "Modifications in the sequence or rank adopted in that catalogue have been made only in cases where more recent work has made such a course necessary. In order that close correspondence shall exist between the two works, and that ready reference may be made from the present manual to the catalogue, the number of the page on which each genus, tribe, and subfamily will be found in Leng's catalogue or its supplement is entered in the list of genera."

The review is by C. W. Leng.

Recent changes in Japanese beetle larval population in Philadelphia municipal parks, H. Fox (*Jour. Econ. Ent., 24 (1931), No. 1, pp. 212–217*).—It is pointed out that changes in Japanese beetle population tend to follow a definite sequence, characterized by an initial rapid increase leading to a period of maximum abundance and followed by a decline.

Distribution of the Japanese beetle (Popillia japonica Newn.) in the United States in 1930, C. H. Hadley and C. W. Stockwell (*Jour. Econ. Ent., 24 (1931), No. 1, pp. 217, 218*).—A brief account of a survey made of the distribution of the Japanese beetle in the United States in 1930.

Trapping for the Japanese beetle (Popillia japonica Newman) during the seasons 1929 and 1930, O. K. Courtney (*Jour. Econ. Ent., 24 (1931), No. 1, pp. 219–226, pls. 2, figs. 2*).—In the use of bait having geraniol as a base in the Japanese beetle trap during the past two years approximately 17,563 traps were used in 1929 and 25,583 in 1930, at an average cost for material and operation of $1.66 per trap in 1929 and $1.63 in 1930. This does not include the cost of the assembled trap.

Recent observations on distribution and abundance of Anomala orientalis Waterhouse and Aserica castanea Arrow in New York, H. C. Hallock (*Jour. Econ. Ent., 24 (1931), No. 1, pp. 204–212, figs. 3*).—This is a summary of the status of knowledge of the distribution and notes on the general abundance

of *A. orientalis* and *A. castanea* in New York State during the past four years. The drought, which was the longest dry period that has been recorded in this area, decreased the abundance of these beetles. The use of lead arsenate in top-dressing lawns helped to reduce the abundance of the beetles.

Notes on three dynastid beetles noxious to the coconut tree in the Dutch East Indies [trans. title], S. LEEFMANS (*Landbouw [Buitenzorg], 6 (1930), No. 6, pp. 657–673, pls. 2; Eng. abs., pp. 670, 671*).—Two dynastids which cause occasional damage to coconut palms in the extreme eastern parts of the Dutch East Indies, namely, *Chalcosoma atlas* L. and *Scapanes australis* Boisd., and a third species, *Papuana semistriata* Arr., which digs into the ground and attacks young coconut trees from beneath the surface on the island of Ceram, are noted.

The tolerance of beans to sprays and dusts for the Mexican bean beetle, H. C. HUCKETT (*Jour. Econ. Ent., 24 (1931), No. 1, pp. 200–204*).—The results of field tests with commercial brands of arsenicals, barium fluosilicate, and cryolite in spray and dust mixtures for the Mexican bean beetle indicate that there is a considerable risk involved in the use of certain forms of arsenicals through injury to plant growth. Of the materials tested, magnesium arsenate, barium fluosilicate, and cryolite were the safest to use on the foliage at the commonly recommended strengths.

The cranberry rootworm as an apple pest, S. W. HARMAN (*Jour. Econ. Ent., 24 (1931), No. 1, pp. 180–182, pl. 1*).—This contribution from the New York State Experiment Station considers the cranberry rootworm (*Rhabdopterus picipes* Oliv.) as an apple pest. The beetles at times cause considerable damage to the apple crop in certain sections, rendering it unfit for sale except to the canner or evaporator. Thorough spraying with lead arsenate has afforded effective protection.

The Great Basin wireworm in the Pacific Northwest, M. C. LANE (*U. S. Dept. Agr., Farmers' Bul. 1657 (1931), pp. II+9, figs. 5*).—This is a practical summary of information on the wireworm *Ludius pruininus* Horn var. *noxius* Hys., which is causing millions of dollars loss annually to the farmers of the Pacific Northwest in those areas receiving less than 15 in. of precipitation, through cutting down the stand of both winter and spring grain in the early spring. Its damage is especially noticeable in a year with a long cold spring and severe injury to the fall-sown grain. Following a discussion of its importance and distribution and the extent and nature of injury, the author presents a description of its several stages, and briefly considers its life history and habits and natural enemies. Under the headings of control measures, the author discusses clean summer fallow, points out that spring harrowing is not recommended, discusses the effect of seed disinfection on wireworms, and points out that seed should be planted more thickly in wireworm-infested land and that chemicals are of no avail against wireworms. Absolutely clean summer fallow is said to be the only effective control of this wireworm.

A brief note on beekeeping in Cyprus (July, 1929), J. E. M. MELLOR (*Bul. Soc. Roy. Ent. Égypte, 23 (1930), No. 2–3, pp. 65–67, pls. 5*).—This account of apiculture in Cyprus is illustrated by accompanying plates.

Beekeeping in Egypt.—Part II, Notes on the improvement of the honey yield in Egypt, J. E. M. MELLOR (*Bul. Soc. Roy. Ent. Égypte, 23 (1930), No. 2–3, pp. 68–74, fig. 1*).—This contribution consists of notes on the honeybee in Egypt.

Another imported ant, M. R. SMITH (*Fla. Ent., 14 (1930), No. 2, pp. 23, 24*).—The author records the occurrence of *Prenolepis (Nylanderia) bourbonica* Forel in Florida, where it was probably introduced on plants.

Notes on the European hornet, E. N. Cory (*Jour. Econ. Ent., 24* (*1931*), *No. 1, pp. 50–52*).—The author reports that the European hornet (*Vespa crabro germana* Christ.) seems to be on the increase in Maryland and apparently is extending its range to other States. This insect, which nests in hollows, injures lilac stems ranging from pencil size up to nearly an inch in diameter by gnawing and sometimes girdling them. It has also been observed at Cordova, in Talbot County, Md., to feed on apples, both on the ground and on fruit on the trees. When once an apple is attacked the wasps continue to hollow it out until nothing but a shell remains hanging on the tree.

Cane pest combat and control, E. Jarvis (*Queensland Agr. Jour., 35* (*1931*), *No. 1, pp. 6–9, figs. 7*).—Notes are presented on the digger wasp or scoliid parasites, particularly *Scolia formosa* Guer., which is closely related to the well-known digger wasps *Campsomeris tasmaniensis* Sauss. and *C. radula* Fab.

The mass production of Macrocentrus ancylivorus, a parasite of the oriental fruit moth, and its distribution from southern New Jersey, H. W. Allen (*Jour. Econ. Ent., 24* (*1931*), *No. 1, pp. 309–314, fig. 1*).—It is stated that the Moorestown, N. J., station of the U. S. D. A. Bureau of Entomology commenced work on the mass production and distribution of *M. ancylivorus* in 1929 and increased its efforts in this direction in 1930. Adults were produced in large numbers and were successfully shipped and liberated in 86 colonies in 13 States. Preliminary recovery collections indicate positive recoveries from slightly less than one-half of the colonies liberated.

The latent parasitism of Ixodiphagus caucurtei in the engorged larvae and unfed nymphs of Ixodes ricinus and Rhipicephalus sanguineus [trans. title], E. Brumpt (*Compt. Rend. Acad. Sci.* [*Paris*], *191* (*1930*), *No. 22, pp. 1085–1087*).—The details are given of several experiments conducted in 1930 to show the latency in development of this parasite and determine the physicochemical cause. It appears that some 83 days pass before signs of parasitism appear in nymphs that have developed from individuals parasitized as engorged larvae.

Two new species of parasitic Hymenoptera (Braconidae) from Ohio, F. DeGant (*Ent. Soc. Wash. Proc., 32* (*1930*), *No. 9, pp. 163–165*).—*Rogas granulata*, taken on cabbage infested with the cabbage looper at Cleveland, and *Macrocentrus harrisi*, from Bedford, Ohio, are described as new.

The life history and control of the birch leaf-mining sawfly, Fenusa pumila Klug., R. B. Friend (*Jour. Econ. Ent., 24* (*1931*), *No. 1, pp. 171–177*).—*F. pumila*, a native of Europe and first reported in the United States in 1924, is now present in the northeastern part of the United States and in southeastern Canada. In Connecticut there are three generations a season, the eggs being laid in the newly developing leaves of birch. In that State it has been found attacking gray, white, and European white birches. Nicotine sulfate appears to be a promising ovicide.

A new spinning mite attacking Asparagus plumosus in Florida, E. A. McGregor (*Ent. Soc. Wash. Proc., 32* (*1930*), *No. 9, pp. 161–163, figs. 6*).—Under the name *Divarinychus floridensis* n. g. and sp. the author describes a spinning mite which attacks the asparagus fern in Florida. The injury occurs chiefly to the more tender growth and young shoots, and where the infestation is heavy the color of the plant is changed from green to whitish.

The typhus-Rocky Mountain spotted fever group, A. Rumreich, R. E. Dyer, and L. F. Badger (*Pub. Health Rpts.* [*U. S.*], *46* (*1931*), *No. 9, pp. 470–480*).—A report of an epidemiological and clinical study of this tick-transmitted affection in the Eastern and Southeastern States.

An infection of the Rocky Mountain spotted fever type, L. F. Badger, R. E. Dyer, and A. Rumreich (*Pub. Health Rpts.* [*U. S.*], *46* (*1931*), *No. 9, pp.*

463–470).—An account of the identification of this tick-transmitted affection in the eastern part of the United States.

Combating scales visited by ants, [trans. title], A. D. Voûte (*Landbouw* [*Buitenzorg*], *6* (*1930*), *No. 6, pp. 713–715; Eng. abs., p. 715*).—The application of tanglefoot to trees infested with Lecanium and other scales at Pasar Minggoo, in Java, thereby preventing the attendance by ants, resulted in the disappearance of most of the scale after one month.

ANIMAL PRODUCTION

Types and market classes of live stock, H. W. Vaughan (*Columbus, Ohio: R. G. Adams & Co., 1930, 13. ed., 3. rev., pp. 574, pl. 1, figs. 221*).—This book, previously noted (E. S. R., 51, p. 274), has been revised by rewriting part of the text, by bringing the livestock statistics up to date, and by the addition of some new illustrations.

[Animal husbandry investigations at the Canadian experimental stations and farms] (*Canada Expt. Farms, Rpts. Supts. 1929, Agassiz* (*B. C.*) *Farm, pp. 6–12, 13–22, 51–55, figs. 4; Cap Rouge* (*Que.*) *Sta., pp. 3–13, 28–34, figs. 4; Charlottetown* (*P. E. I.*) *Sta., pp. 6–12, 44–54, figs. 4; Farnham* (*Que.*) *Sta., pp. 20, 21; Fredericton* (*N. B.*) *Sta., pp. 5–13, 50–67, figs. 2; Indian Head* (*Sask.*) *Farm, pp. 6–13, 42–45; Kapuskasing* (*Ont.*) *Sta., pp. 4–13 49–53; Lennoxville* (*Que.*) *Sta., pp. 5–19, 61–72. figs. 2; Nappan* (*N. S.*) *Farm, pp. 4–24, 57–67; Rosthern* (*Sask.*) *Sta., pp. 4–7, 8–25, 54–59; Sidney* (*B. C.*) *Sta., pp. 4–6, 54–62, fig. 1; L'Assomption* (*Que.*) *Sta. Rpt. Supt. 1928–1929, pp. 9, 10; Windermere* (*B. C.*) *Sta. Rpt. Supt. 1928–1929, pp. 9, 10, 11–16, 40–48, figs. 3*).—In these publications (E. S. R., 62, p. 548) brief reports are given by W. H. Hicks, G. A. Langelier, J. A. Clark, R. Bordeleau, C. F. Bailey, W. H. Gibson, S. Ballantyne, J. A. McClary, W. W. Baird, W. A. Munro, E. M. Straight, J. E. Montreuil, and R. G. Newton, respectively, on the results of feeding and breeding experiments with horses, beef and dairy cattle, sheep, swine, and poultry.

Inspection of commercial feedstuffs, P. H. Smith et al. (*Massachusetts Sta. Control Ser. Bul. 55* (*1930*), *pp. 44*).—The results of the chemical and microscopic analyses of 1,738 samples of feeding stuffs collected for official inspection during the year ended September 1, 1930, are contained in this, the thirty-sixth annual report (E. S. R., 63, p. 163).

Rations for fattening range calves in Arizona, E. B. Stanley (*Arizona Sta. Bul. 137* (*1931*), *pp. 615–638, fig. 1*).—Continuing earlier work (E. S. R., 56, p. 560), series of four studies were conducted during the years 1927 to 1930, inclusive, to determine economical rations and methods of feeding range calves under Arizona conditions. High-grade calves of mixed Hereford and Shorthorn breeding were started on feed at from 6 to 9 months of age and fed in lots of from 10 to 12 head each for 180 days. Both steer and heifer calves were fed. Rolled barley and cottonseed meal were fed in the proportions of 5 : 1, 4 : 2, and 3 : 3, at an average level of 5.8 lbs. per head daily, with and without hegari silage, and alfalfa hay was fed to all lots.

When silage was fed, half of the barley in the ration could be replaced with cottonseed meal without materially influencing the rate or efficiency of gains and at a saving of 5.75 per cent in the feed cost per 100 lbs. of gain. When no silage was fed, a barley-cottonseed meal ratio of 5 : 1 was superior to a ratio of 4 : 2. Two trials showed no difference in the relative feeding value of cracked hegari and rolled barley. Adding a simple mineral mixture to a ration of alfalfa hay, rolled barley, and cottonseed meal had no beneficial effect and

increased the cost of the ration. The addition of silage to a ration of barley-cottonseed meal 5 : 1 and alfalfa hay for heifer calves did not alter the rate of gain.

A ration of alfalfa hay, hegari silage, and cottonseed meal with a limited amount of barley during the latter half of the feeding period produced the most economical returns in this test. The calves were subject to attacks of chronic bloating when fed alfalfa hay, rolled barley or cracked hegari, and cottonseed meal, and more bloating occurred when the grain-meal mixture was 4 : 2 than when it was 5 : 1. No disturbing effects were evident when the calves were fed a high proportion of cottonseed meal with silage, alfalfa hay, and barley.

It was possible to feed these calves weighing from 375 to 450 lbs. per head initial weight so that they gained at least 2 lbs. daily at a feed cost of about $9 per 100 lbs. of gain. The animals acquired a satisfactory market finish in from 150 to 180 days and returned a margin of $1.50 to $2 per 100 lbs. Calves that had received a serious setback during their growing period, due to drought conditions on the range, consumed 10 per cent more roughage, made a 13 per cent smaller daily gain, and required 23 per cent more feed to produce 100 lbs. of gain than the average calves.

Producing native lambs, C. Harper (*Indiana Sta. Bul. 344 (1930), pp. 28, figs. 4*).—Concluding this 3-year study (E. S. R., 63, p. 557) in cooperation with the U. S. D. A. Bureau of Animal Industry, an effort was made to determine the comparative values of pasture crops for producing market lambs running with their suckling dams.

In these tests pasture produced larger and more economical gains and a better market finish, and returned a greater profit over feed costs than harvested feeds. Unweaned lambs on pasture with their dams made greater and more economical gains and had a better finish than lambs whose mothers were fed shelled corn, oats, and alfalfa hay. Pasture lambs returned $4.61 more per head than the lambs of the grain-fed dams. Lambs on pasture made larger and cheaper gains than lambs fed corn and alfalfa in a creep. The finish was practically the same in both lots, but the pasture lambs returned $1.99 more per head than the creep-fed lambs. Lambs on pasture with access to corn in creeps made somewhat larger gains than lambs on pasture only, but the finish was about the same in both lots and the returns were slightly in favor of the lambs on pasture only. Lambs on pasture and fed corn in a creep made somewhat larger and more economical gains than lambs fed corn and alfalfa hay in dry lot. The dry-lot lambs sold for a slightly higher price, but the pasture lambs returned 88 cts. more per head than the dry-lot lambs.

Fattening western lambs (type test), C. Harper (*Indiana Sta. Bul. 343 (1930), pp. 16, figs. 8*).—Concluding this 4-year study (E. S. R., 63, p. 557) in cooperation with the U. S. D. A. Bureau of Animal Industry, no outstanding differences were found in the four types, Rambouillet, Corriedale, Hampshire-Rambouillet, and Hampshire-Corriedale, of feeder lambs studied. As feeders the Corriedales cost the most and the Rambouillets the least. The Hampshire-Rambouillets made the largest and most economcial gains, followed by the Hampshire-Corriedales and Corriedales, while the Rambouillets made the poorest gains. The lambs of Corriedale breeding, both high grades and crossbreds, finished at a good weight, while the Hampshire-Rambouillets were too heavy in weight and slightly coarse when finished, and the Rambouillets were not as fat as the other groups nor as uniform in finish and were slightly pelty. On the basis of original cost, rate of gains, cost per unit of gain, finish, and

financial returns, the Hampshire-Corriedale crossbreds had a slight advantage over the other types.

Fattening lambs, P. S. Jordan and W. H. Peters (*Minnesota Sta. Bul. 272* (*1930*), *pp. 26*).—Concluding this series of studies (E. S. R., 57, p. 268), an attempt was made in eight different tests, using eight lots of 30 lambs each in all tests but one, in which only five lots were used, to determine the relative value of various concentrates and roughages for fattening lambs, and also the most efficient form and method of feeding.

At normal price levels it was found economical to add a protein supplement to a ration of corn and alfalfa hay. Adding a protein supplement to a ration of ground barley and a legume hay increased the rate of gain and also slightly increased the cost of gain. Linseed meal, cottonseed meal, and corn gluten meal were practically equal in value as supplements to an ear corn-alfalfa hay ration, and there was little or no advantage gained by combining two of the supplements. However, the combination of the three supplements in equal proportions showed a decided advantage over any single one or a combination of any two of the supplements.

The use of a self-feeder proved to be satisfactory when a full feed of grain was desired. Whole grain was more satisfactory than ground grain for fattening lambs, and good quality sweetclover hay was successfully substituted for alfalfa hay. Ear corn was found to be practical for fattening lambs during the early fall months, but did not produce as rapid or as economical gains as shelled corn. Barley was found to be practically equal to ear corn, and both corn and barley were superior to oats as a single grain in the fattening ration. Using oats instead of corn or barley during the early part of the feeding period or adding them to a ration of corn and barley, linseed meal, and alfalfa hay decreased the rate and increased the cost of gains.

Thrifty vigorous feeder lambs, weighing from 40 to 55 lbs., proved to be as satisfactory as heavier lambs and returned as great a profit per head. Such lambs can frequently be purchased more economically than heavier lambs.

Range sheep and wool in the seventeen Western States, F. S. Hultz and J. A. Hill. (*New York: John Wiley & Sons; London: Chapman & Hall, 1931, pp. XVII+374, pl. 1, figs. 78*).—Part 1 of this treatise, by Hultz, deals with the breeding, feeding, management, and marketing of sheep under range conditions. Part 2, by Hill, deals with the status of wool, wool classifications, the wool fiber, the marketing and manufacture of wool, laboratory tests with wool, and the judging of range sheep for wool.

Variations in diameter and crimp of wool of different parts of the body of Merino sheep, J. H. W. T. Reimers and J. C. Swart (*Union So. Africa Dept. Agr., Sci. Bul. 83* (*1929*), *pp. 60, figs. 22*).—Samples of wool from Merino sheep were taken from the shoulder, the back of the thigh, the side, the belly, in a fold on the neck, and on a fold on the neck, then measured at the Stellenbosch-Elsenburg College of Agriculture, South Africa, to determine variations in the diameter and crimp of wool fibers.

It was found that on the average the wool fibers from the side and belly were as fine as those from the shoulder. The wool from the back of the thigh was coarser than wool from other parts of the body except the neck, where the coarsest wool was found. Individual sheep varied greatly and irregularly in these respects. There was also a great deal of variation in wool taken in a fold or on a fold.

The diameter of wool fibers from the belly and the inside of a fold was slightly more uniform than fibers from the shoulder and side. The wool on a fold was quite variable in diameter, while that from the back of the thigh

showed the greatest variability. No relationship was found between the average diameter of the fibers and the number of crimps in wool fibers from different parts of the body. As a rule, wool in a fold had more crimps than wool on a fold in the same individual.

Variations found in fineness, diameter, and uniformity of fibers suggest the possibility of breeding sheep carrying a covering of uniform wool over the entire body. It is suggested that the pointed distribution curve for the majority of wool samples (with reference to diameter of fibers) may have been caused by the influence of selection through generations. The fact that the majority of the fibers tended to be coarse may have been caused by crossing breeds with different wool types or to differences in the kind of fibers making up the fleece of a sheep.

Swine performance record—litter comparisons, C. C. CULBERTSON, J. M. EVVARD, H. H. KILDEE, M. D. HELSER, ET AL. (*Iowa Sta. Bul. 277 [1931], pp. 85–116 figs. 4*).—In this study in cooperation with the U. S. D. A. Bureau of Animal Industry, 4 pigs from each of 44 purebred and crossbred litters, containing 8 or more living pigs at farrowing, were fed from the time they were 65 days old to an average final weight of 225 lbs. The average daily gains ranged from 1.13 to 1.68 lbs. per head, with an average for all litters of 1.38 lbs. per pig. The pigs in 41 per cent of the litters made less than the average daily gain. The feed requirements per 100 lbs. of gain ranged from 358 to 468 lbs., with an average for all litters of 398 lbs., and 41 per cent of the litters required more than the average amount of feed.

The proportion of the various carcass cuts of the pigs varied considerably among the different litters. The 225-lb. pigs from the high-yielding litter returned about $3.92 more pork products than the small pigs from the low-yielding litter.

These results indicate that there is a wide variation in the efficiency of the breeding stock.

Reproductive disturbances caused by feeding protein-deficient and calcium-deficient rations to breeding pigs, H. R. DAVIDSON (*Jour. Agr. Sci. [England], 20 (1930), No. 2, pp. 233–264, figs. 8*).—In this study at Cambridge University, England, three groups of six gilts each, similar as to breeding and previous management, were placed on experiment at six months of age. The control group received a ration adequate in protein, energy, the more important minerals, and vitamins A, B, C, and D. The calcium-deficient ration was the same as the basal ration with the exception of ground limestone, while in the protein-deficient ration the blood meal was omitted and a mineral mixture added to make up for the minerals withdrawn with the blood meal. As each gilt reached sexual maturity she was bred, and four of the gilts in each lot were killed after three months in pig. The number of ova produced in each case were determined by the number of corpora lutea, and the number of normal and atrophic fetuses were also determined.

The results of this study show that partial atrophy in sows is not due to a protein deficiency and that calcium deficiency is not the major factor, though it may be a contributing factor. When the minerals of the blood meal were omitted there was a considerable delay in the return of oestrum after weaning. A calcium deficiency did not produce an immediate effect upon the sow, but did lead to an increase in the number of pigs born dead. It also reduced the sow's milk supply and eventually led to a failure of the supply.

None of the results disproved conclusions of other workers that fetal degeneration of a partial nature is probably due to factors inherent in the zygote itself.

The influence of the growth and fattening processes on the quantity and quality of meat yielded by swine, E. L. Scott (*Indiana Sta. Bul. 340 (1930), pp. 105, figs. 15*).—In this study (E. S. R., 63, p. 558) 997 hogs were slaughtered and subjected to a detailed study on an individual basis to determine the effect of breeding, type and rate of gain on the quantity and quality of pork produced, and the fundamental relationships governing the dressing qualities of swine. For the purposes of the study lard hogs were divided into three type groups, medium minus, medium, and medium plus, based on the age-corrected aitch-to-rib and aitch-to-toe measurements of the individual.

In this study a definite relationship was found between maturity and quality of meat. The fat of the young swine was soft, but it gradually hardened during the growth and fattening process. The results showed that the different types did not reach maturity at the same time, even when full-fed well balanced rations, and quality pork was produced by the types at different weights and depths of fat. The medium minus hogs had attained optimum quality before being marketed in this study, while the medium and medium plus groups became firm at average depths of fat of 2.89 and 3.19 cm., respectively, corresponding to weights of 191 and 219 lbs. These data show that maturity is an important factor with soft pork in view of the fact that hogs are now being marketed at lighter weights, and also since breeding stock of increased length-type are being used.

The percentage of fat in the fat tissues increased and the percentages of moisture and protein decreased as the depth of the fat covering increased. The changes were accompanied by a lowering of the refractive index and an improvement in the quality of meat. Hogs having a high dimensional ratio or those thick in lean meat in proportion to length hardened at a lesser depth of fat than hogs with a low dimensional ratio. A given increase in the depth of fat of the former hogs produced a greater change in the quality of pork than a corresponding increase in the latter hogs.

A method for removing fat samples from live hogs (E. S. R., 64, p. 759) is described.

Appended is a bibliography of the literature cited and tables giving correlation distributions and data.

Self-feeder for hogs, G. Bohstedt (*Wisconsin Sta. Bul. 419 (1931), pp. 24, figs. 14*).—The advantages of the self-feeder, the essential features and plan of the Wisconsin self-feeder, together with a bill of material for its construction, and the use of self-feeders for feeding swine are discussed in this bulletin.

Notes on swine raising in the Philippines, A. Tuason (*Philippine Bur. Anim. Indus. Bul. 1 (1930), pp. 29, pls. 18*).—A practical bulletin dealing with the breeding, feeding, and management of swine under Philippine conditions.

Practical poultry production, H. M. Lamon and J. W. Kinghorne (*St. Paul, Minn.: Webb Book Pub. Co., 1930, rev., pp. 438, pl. 1, figs. 323*).—A thoroughly revised and enlarged edition of this treatise, previously noted (E. S. R., 47, p. 496).

How to select the laying hen, H. M. Lamon and J. W. Kinghorne (*New York: Orange Judd Pub. Co., 1931, pp. 124, pls. 15, fig. 1*).—This book was designed to furnish information on the principles and practices of culling the poultry flock.

Cod-liver meal experimentation on chicks and breeding birds, H. O. Stuart and T. B. Charles (*Poultry Sci. Assoc. Proc., 22 (1930), pp. 41–44; also New Hampshire Sta. Sci. Contrib. 30 (1931), pp. 4*).—Concluding this study (E. S. R., 63, p. 267), it was found that cod-liver meal at the rate of 0.5, 1, or 2 per cent contained sufficient antirachitic properties to prevent the appear-

ance of rickets. On the basis of hatchability of eggs, cod-liver meal was superior to cod-liver oil for breeding purposes. Birds fed cod-liver meal also showed better pigmentation and more uniformity of growth than those fed cod-liver oil. The excessive use of cod-liver oil was detrimental to chicks, and there were indications that some factor in it prevented the assimilation or deposition of yellow pigment. While fish meal fed at a 5 per cent level did not produce as good growth as the other supplements, it was evident that it contained enough of the antirachitic factor to prevent rickets in chicks to 8 weeks of age..

The maintenance requirement of the fattening cockerel, with a note on a proposed new method for the determination of the surface area of birds, B. A. Southgate (*Jour. Agr. Sci. [England], 20 (1930), No. 2, pp. 206–212*).—In a study at Cambridge University, England, it was found that the maintenance requirement of Light Sussex Cockerels as determined by a feeding trial and comparative slaughter method was 22.1 calories per square meter of body surface per hour. The ration fed, consisting of ground Sussex oats and dried whole milk 13:3, had a net energy value of 1.8 calories per gram.

A proposed new method for determining the surface area of birds is described by E. T. Halnan and Southgate. The formula $A=KW^{2/3}$, in which A equals the surface area in square meters, K the net calories per gram of dry feed, and W the weight, was used for these determinations. The value of K in this equation was found to be 9.3.

Battery brooding, M. H. Arndt (*New York: Orange Judd Pub. Co., 1931, pp. 323, figs. 74*).—Detailed instructions for the successful operation of battery brooders are presented in this treatise.

Mississippi egg storage test, G. R. Sipe (*Mississippi Sta. Circ. 94 (1930), pp. 6*).—To determine the storage qualities of southern eggs, 26 cases of eggs were placed in cold storage at from 29 to 31° F. for 168 days. Two of the cases were western eggs used as a check; 19 cases were Mississippi eggs produced with a balanced ration containing 5 per cent or less of cottonseed meal; 1 case was produced with a ration containing 20 per cent of cottonseed meal; 3 cases were produced by farm flocks fed corn, grass, bugs, and table scraps; and 1 case was purchased from a country store. With the exception of the store case, all the eggs were in storage before they were 1 week old.

The Mississippi eggs which were produced on a balanced ration showed a gain of 0.03 per cent in grade during the storage period. The farm eggs also stored well when purchased direct from the farmer and placed in storage before 1 week of age. The eggs procured from the country store had a low storage efficiency. There was little difference in the storage qualities of western and Mississippi eggs produced under good conditions. Green or olive-yolked eggs occurred seriously only when large amounts of cottonseed meal were used in the ration.

DAIRY FARMING—DAIRYING

Minutes of the fifteenth annual meeting, western division, American Dairy Science Association (*Amer. Dairy Sci. Assoc., West. Div., Minutes Ann. Meeting, 15 (1929), pp. [50]*).—The proceedings are given, in mimeographed form, of this meeting, held at Portland, Oreg., October 27 and 28, 1929 (E. S. R., 62, p. 164).

Supplements to a milk diet for dairy calves, C. Y. Cannon (*Iowa Sta. Research Bul. 136 (1931), pp. 65–103, figs. 18*).—High-grade Holstein calves, which were still taking colostrum, were selected for this study to determine the effect of a whole milk diet alone and with various supplements on the health and

growth of the animals. The calves were kept in well-lighted pens with outside runs, and when necessary muzzles were used to prevent them from picking up things to eat.

Rickets and anemia are the two factors responsible for the inability to raise calves on a diet of whole milk alone. Tetanic convulsions in calves are probably associated with rickets, but no calves in this study developed rickets, since they all received cod-liver oil and bone meal. The calves on a milk diet became anemic as measured by the reduced quantity of hemoglobin, the subnormal erythrocyte count, and the lower specific gravity of the blood. Calves also became dyspneic, showed a great weakness, and lacked color around the tongue and muzzle. When roughages such as alfalfa hay and oat straw were fed, these conditions improved markedly, and the blood also returned to normal.

If alfalfa hay and grain were fed for a period before feeding a whole milk diet, sufficient quantities of iron were stored to prolong the length of apparent good health, but at the end of the test the blood was subnormal, even though the animals appeared vigorous. Feeding minimum amounts of milk supplemented with alfalfa flour permitted the calves to maintain a healthy appearance of hide, but the calves were underfed and several animals died of starvation.

The calves on milk diets grew faster in skeletal development than normal, and when allowed optional amounts of milk were above normal in weight. These results indicate that calves are capable of consuming sufficient quantities of liquid whole milk for normal growth curves.

Selection and care of the dairy sire, R. H. LUSH (*Louisiana Stas. Circ. 5 (1931), pp. 32, figs. 6*).—The importance of using purebred dairy bulls of the better class and the methods used in the selection of such bulls are described in part 1 of this publication, while part 2 deals with the care and management of dairy bulls.

The analysis of the lactation curve into maximum yield and persistency, H. G. SANDERS (*Jour. Agr. Sci. [England], 20 (1930), No. 2, pp. 145–185, figs. 10*).—Based on data previously noted (E. S. R., 61, p. 263), an attempt was made to analyze the lactation yield into its two components, maximum yield and persistency.

Maximum yield was found to be subject to a rather rigid limit, largely determined by the area of the mammary gland, but persistency appeared to be mainly a nutritional factor. Persistency was high in the dairy-type cow and appeared to be associated with good constitution. Changes in standardized maximum yield from one lactation to another of the same cow were negatively correlated with changes in standardized persistency. Persistency was largely affected by the length of the service period, while maximum yield was only slightly affected. A dry period of 40 days was necessary for the full development of maximum yield, but any further rest period was reflected only in increased persistency. The effect of the month of calving on the lactation yield of persistent cows was much lower as compared with nonpersistent cows, and the latter showed a greater age variation, a rise of 40 per cent from the first to the sixth lactation, as compared with 25 per cent.

Milking at three eight-hour intervals as a means of investigating variations in the fat and solids-not-fat, K. W. D. CAMPBELL (*Jour. Agr. Sci. [England], 20 (1930), No. 2, pp. 213–232, figs. 2*).—A study at the University of Reading, England, was undertaken to determine the effect of three daily milkings on the yield of individual cows and of the herd as a whole and the effect on the butterfats. A group of nine cows and three heifers was used throughout the study.

The increase in the milk production of the cows was within the limits normally expected in the case of three milkings daily. However, the increase for the heifers was below expectation. There was little difference in the number of low fats produced by individual cows whether milked at three regular or two irregular periods daily. The bulk milk of the cows milked three times daily maintained a high standard of fat because each cow maintained a fairly high fat level consistently at one specific milking, but this specific milking was not the same for all cows.

Evidence is introduced to show that there is some factor operating at night which results in a low production of fat, and that the factor operates whether the night period is short or long. When the period is long, milk secretion is stimulated at a faster rate than fat secretion, which results in the morning milk being low in fat.

Bacteriological investigations of milking machines, A. G. Lochhead and C. K. Johns (*Canada Dept. Agr. Bul. 127, n. ser. (1929), pp. 37, figs. 11*).—A series of five studies was conducted by the Department of Agriculture, Dominion of Canada, to determine the factor or factors involved in the production by milking machines of high-grade milk with a low bacterial contamination as compared with that produced by good hand milking.

Tests with four makes of milking machines showed that the type or design of the machine was of minor importance from a bacteriological standpoint. Such factors as the washing and drying of the cow's udder, the use of disinfectants to wash the udder, discarding the foremilk, and the manner of handling the teat cups were considered minor factors in the contamination of machine-drawn milk. The sanitary condition of the rubber parts of the machine was found to be the most important factor affecting the bacterial content of the milk.

Satisfactory control of contamination depended upon adequate cleaning and sterilizing of the machine. The simple, practical method which was found to give the best results consisted of washing with cold water, followed by hot cleanser solution and clear hot water, and sterilizing by the use of chemicals. The chloramine-brine treatment, because of its stability, gave the best results of the chemicals used. In studying the chemical sterilizers, it was discovered that the treatments which were less successful from a quantitative standpoint were also less satisfactory from a qualitative standpoint for destroying bacteria.

Appended are directions for washing and sterilizing milking machines and the results of the analyses of 50 samples of chloride of lime.

Sixteenth annual report of the creamery license division, T. H. Binney (*Indiana Sta. Circ. 176 (1930), pp. 19, fig. 1*).—This is the annual report of the creamery license division for the year ended March 31, 1930 (E. S. R., 62, p. 665). Indiana dairy statistics for 1929, creamery and glassware inspection, and the examination of testers are discussed. Appended is a list of the licensed manufacturing plants of the State.

Bacteriology of butter.—I, Influence of the distribution of the nonfatty constituents on the changes in bacterial content during holding, B. W. Hammer and R. V. Hussong (*Iowa Sta. Research Bul. 134 (1930), pp. 17–30*).—In this study a lot of butter was divided into three portions. Portion A was subjected to a bacterial count at the first examination, portions A and B at the second examination, and portions A, B, and C at the third examination. By this method part of the butter was examined in the normal physical condition, and part had had the serum separated for different periods. The bacterial counts were made on both the unsalted and salted butter on the

cubic centimeter basis by the plate method. Beef infusion agar was used, and incubation was for 4 days at 21° C.

Unsalted butter held at 21° showed a rapid increase in number of bacteria whether held in normal physical condition or with the serum largely separated, but the increase was much more rapid when the serum was separated. Similar butter held at 7° also showed an increase in the number of bacteria when held in both forms, but the increase was less rapid than at 21°. Again the increase was more rapid when the serum was separated. Salted butter held at 21° tended to decrease in number of bacteria when held in either condition, and in general the rate of destruction was greater when the serum was separated. The same was true of salted butter held at 7°, except that at this temperature there was less tendency for the separation of serum to increase the rate of destruction than at 21°.

Preventing taint in whipped cream used by the fancy department, P. H. Tracy (*Ice Cream Trade Jour., 26 (1930), No. 5, pp. 61–63*).—Studies at the Illinois Experiment Station showed that a bitter, woody, surface taint developed in from 2 to 3 days on the surface of whipped cream stored in a hardening room. This taint was absorbed from the air and was traced to certain odors rising from exposed wooden surfaces in the hardening room and anterooms. Ash and yellow pine were found to cause the whipped cream to acquire this woody flavor, and the pine was especially bad in this respect. Some woods that did not produce this flavor defect when dry did produce the woody taint when wet. It is concluded that decorated fancy ice cream should be covered as nearly air tight as possible when placed in the hardening room in order to minimize the danger of surface taint, and that the same is true of ordinary ice cream.

What are the effects of using egg as an ingredient of the mix? D. A. Pettee and M. J. Mack (*Ice Cream Trade Jour., 26 (1930), No. 9, pp. 55–57, figs. 6*).—The Massachusetts Experiment Station conducted a series of experiments to determine the relative benefit of egg product when used in ice creams of different fat and serum solids content, the relative effect of age when the source of fat and serum solids was varied, and the effect of the different forms of egg on flavor, body, and texture, and resistance to melting.

The results of these studies showed that all forms of egg yolk decreased the freezing time of ice cream mixes. Fresh egg yolk was the most effective in this respect, and dehydrated yolk was superior to frozen yolk. Fresh and frozen yolk were most effective for reducing freezing time when added to the cold mix previous to aging, but to secure uniform incorporation it was found advisable to add these products just before homogenizing. The greatest benefit was derived from the dehydrated yolk in decreasing the whipping time of a mix by adding this ingredient just before homogenizing.

Egg yolk decreased the freezing time of a butter mix more than it did that of a cream or cream and butter mix, and also decreased the freezing time of a mix low in butterfat more than that of a mix high in butterfat. Adding egg yolk improved the whipping properties of a high serum solids mix more than that of a mix low in serum solids. Egg albumin apparently had no effect on freezing time, while the salts present in egg yolk might have been partly responsible for the decreased whipping time which followed the addition of yolk to ice cream mix.

The improvement in quality due to the addition of egg yolk was not sufficient to pay for the added cost.

What type of flavoring is best to make chocolate ice cream? N. E. Fabricius (*Ice Cream Trade Jour., 26 (1930), No. 6, pp. 59, 60*).—A good grade of

cocoa was found to impart a more desirable flavor to ice cream in studies at the Iowa Experiment Station than either chocolate liquor or prepared chocolate. A careful selection of the cocoa used also aided in improving the flavor. The addition of such ingredients as cinnamon and caramel modified rather than improved the flavor of chocolate ice cream, and the improvement in flavor produced by the use of vanilla extract was not evident enough to justify the expense. Homogenizing chocolate ice cream mixes had no effect on the flavor.

Facilitating the control of overrun in the freezing of sherbets, N. E. FABRICIUS (*Ice Cream Trade Jour., 26 (1930), No. 9, pp. 49, 50*).—In a study of the control of overrun during the freezing of sherbets at the Iowa Experiment Station, a number of runs were made to compare half and full batches frozen at various brine temperatures.

A smoother bodied product was obtained when half batches were frozen, probably due to more rapid crystallization and to a lower drawing temperature, which undoubtedly resulted in a smaller quantity of unfrozen water per crystal growth during hardening. When half batches were frozen the use of agar and gum to control overrun was unnecessary. These products, besides imparting an undesirable flavor, made it possible to freeze back to the desired overrun before a low enough drawing temperature was reached, and this resulted in lower body scores.

Using gelatin alone as a stabilizer and freezing half batches at a brine temperature below 0° F. gave satisfactory results from the standpoint of overrun control and body of finished sherbet. Freezing half batches did not reduce the capacity of the freezer, for the desired consistency at the proper overrun was obtained in less than half the time required for full batches.

Honey in ices and sherbets, H. A. SMALLFIELD (*Ice Cream Trade Jour., 26 (1930), No. 12, pp. 35, 36*).—The Ontario Agricultural College conducted some studies to determine the advisability of using honey for preventing crystallization of sucrose in ices and sherbets, the percentage and grade of honey best suited for this use, the effect of the use of honey on cost, and whether or not the honey would blend satisfactorily with various flavors.

It was found that the use of honey prevented the crust formation on exposed surfaces of ices and sherbets. The most desirable results were obtained when 8 per cent of honey was used with 22 per cent of sucrose. The use of honey grading lower than golden (U. S. grade—extra light amber) imparted a strong flavor and was unsatisfactory. The honey blended well with the various flavors that are used in water ices. In sherbet mixes where whole milk was used the addition of honey was found not to be advisable since the milk and honey do not blend well, but where ice cream mix was used this defect did not occur. The use of honey increased slightly the cost of the mix.

VETERINARY MEDICINE

Bacteriological technique, J. W. H. EYRE (*London: Baillière, Tindall & Cox, 1930, 3. ed., [rev.], pp. XII+[1]+619, pl. 1, figs. 238*).—The subject of bacteriological technic is dealt with in 22 chapters and an appendix. The chapters on methods of identification and study (pp. 314–380), experimental inoculation of animals (pp. 381–423), methods of testing pathogenesis and establishing active immunity (pp. 424–443), the study of experimental infections during life (pp. 444–471), post-mortem examinations of experimental animals (pp. 472–483), the study of the pathogenic bacteria (pp. 484–490), and bacteriological analyses (pp. 491–588) are of particular interest to the animal pathologist.

Indiana plants injurious to livestock, A. A. HANSEN (*Indiana Sta. Circ. 175 (1930), pp. 38, figs. 28*).—Following an introductory account, brief summaries of information are given of the species of toxic plants that have been found to be causing the greatest damage in Indiana. With few exceptions, their dangerous properties have been determined experimentally, and their practical importance has been judged as a result of the field work.

"Field investigations on 420 farms in the State have established that white snakeroot, cocklebur sprouts, waterhemlock, and wild cherry are the most important toxic species in Indiana, although the aggregate loss caused by sweetclover hay, black locust bark, the staggerweeds, and buckeye sprouts and nuts is heavy. In addition, a number of miscellaneous plants such as Jimson weed, nightshade, scouring rush, and peach foliage occasionally cause trouble."

Studies upon Astragalus campestris, a poison plant, A. R. MCLAUGHLIN (*Jour. Amer. Vet. Med. Assoc., 78 (1931), No. 2, pp. 225–228*).—The author's studies led to the conclusion that *A. campestris*, a close relative of the loco plants to which the loss of sheep in southwestern Wyoming has been attributed, contains a substance capable of injuring the walls of the capillaries, thereby altering their permeability. This altered permeability is more readily apparent in the delicate tissues of the lungs than elsewhere in the animal body.

"In the case of rabbits, and probably also in sheep, ever-present bacterial organisms invaded the scene and produced the picture recorded. Dogs, because of a much higher resistance and the warmer weather, survived this congestion without revealing any external symptoms. It is probable also that this or another substance is responsible for the injury to the kidneys, thereby causing the slight nephritis noted. The fact that intravenous injection of extracts of this plant in cats, dogs, and sheep, prepared for making kymographic records of blood pressure and respiration, cause intermittent respiration and even death by respiratory inhibition shows it to have a powerful depressant action upon the respiratory center."

[Work in animal pathology] (*Amer. Assoc. Med. Milk Comns. [etc.] Proc., 24 (1930), pp. 103–115, 181–184, 282–305, 306–320*).—The contributions relating to animal pathology here presented are as follows: Recent Progress in Brucella Infection Studies, by I. F. Huddleson (pp. 103–111); Induced Infectious Abortion in Cows on Different Rations, by F. B. Hadley (pp. 111–115); Experimental Infection with *Streptococcus epidemicus* of Monkeys and Cows, by W. D. Frost, F. B. Hadley, D. J. Davis, P. F. Clark, M. Gumm, E. G. Hastings, and W. E. Welsh (pp. 181–184); Mastitis, by D. H. Udall (pp. 282–288); Bang Disease Control, by T. E. Munce (pp. 293–305); Buying Replacements Subject to the Agglutination Test, by J. G. Hardenbergh (pp. 306–312); and Review of Abortion Control Work, by C. Way (pp. 312–314).

Surra and its control in the Dutch East Indies, S. BAKKER (*Over de Surra en Hare Bestrijding in Nederlandsch-Indië. Thesis, Univ. Utrecht, 1930, pp. 180; rev. in Trop. Vet. Bul., 18 (1930), No. 4, pp. 140–142*).—A summary, based upon a review of the literature and work conducted, is reported in six chapters, including a bibliography of 172 references.

Tularemia from the fox squirrel: Report of case, T. KIRKWOOD (*Jour. Amer. Med. Assoc., 96 (1931), No. 12, pp. 941, 942*).—This is a report of a case of tularemia contracted from a fox squirrel in Illinois, it being the second case of tularemia traceable to a tree squirrel, the first having been contracted from a black squirrel in Kansas in November, 1928.

Contribution to the bacteriology and pathology of the bovine udder, L. B. SHOLL and J. P. TORREY (*Michigan Sta. Tech. Bul. 110 (1931), pp. 31, figs. 5*).—In this contribution, a continuation of similar work reported by Run-

nells and Huddleson (E. S. R., 56, p. 578), the authors first consider the earlier work on the subject. In summary tables the authors present a correlation between the bacteriological and histopathological findings.

"Forty-one animals were positive to the agglutination test for *B. abortus*. These represent a total of 164 quarters. Forty-one quarters show *B. abortus* bacteriologically. In 26 of these there is moderate to marked interstitial mastitis. Only 4 show moderate to marked exudative mastitis. Twenty-one quarters show moderate to marked fibrosis. Only 1 is negative histologically. Many quarters show all three conditions in variable degree. These figures show the marked predominance of interstitial mastitis associated with *B. abortus* infection. Three quarters show *B. abortus* and streptococci, and the only marked changes are interstitial mastitis and fibrosis. Thirty-nine quarters show streptococci bacteriologically, and here again there is predominance of the interstitial type of inflammation. Thirty-five quarters show moderate to marked interstitial mastitis, 10 show moderate to marked exudative mastitis, and 25 show moderate to marked fibrosis. Fifty quarters are negative bacteriologically. Twenty-eight quarters show moderate to marked interstitial mastitis, 7 show moderate to marked exudative mastitis, 22 show moderate to marked fibrosis, and only 2 are negative histopathologically. Twenty-eight of the negative quarters had previously showed positive milk cultures."

There were 32 animals and 128 quarters with negative serological reaction to the agglutination test for *B. abortus*. Three quarters representing 3 cows show *B. abortus* bacteriologically. "Thirty-eight quarters show streptococci bacteriologically. Nine quarters show moderate to marked interstitial mastitis, 26 show moderate to marked exudative mastitis, 26 show moderate to marked fibrosis, and 2 are negative histopathologically. There is a definite predominance of exudative mastitis in these cases. Eighty quarters are negative bacteriologically. Thirteen quarters show moderate to marked interstitial mastitis, 6 show moderate to marked exudative mastitis, 30 show moderate to marked fibrosis, and 33 are negative histopathologically. Of the 80 negative quarters, 14 previously showed positive milk cultures. . . . In the animals negative to the *B. abortus* agglutination test, the proportion of bacteriologically negative quarters which are negative histopathologically is much greater than in the positive animals. In the positive animals, the predominating change noted in bacteriologically negative quarters is an interstitial mastitis. In the animals positive to *B. abortus* agglutination, the predominance of interstitial mastitis in quarters showing streptococci infection is a paradox for which the authors have no definite explanation. It has been noted that when streptococcic infections are present it is seldom possible to obtain cultures of *B. abortus*. It may be that some of the quarters were at some time involved by *B. abortus* infection.

"As the result of these studies the authors believe that *B. abortus* produces definite changes in the udder which may be quite extensive and may lower the efficiency of the organ considerably."

Johne's disease in cattle ([*Gt. Brit.*] *Min. Agr. and Fisheries Bul. 26* (*1931*), *pp. III+7, pl. 1*).—This is a practical account.

Reactors in tuberculin-tested (licensed) herds, A. B. Fowler and N. C. Wright (*Hannah Dairy Research Inst. Bul. 2* (*1931*), *pp. VI+7–51*).—Part 1 of this account deals with the incidence of reactors in tuberculin-tested herds (pp. 11–15), part 2 with sources (pp. 16–42), and part 3 with recommendations (pp. 43–51).

"Scabby mouth" in sheep and goats (infectious labial dermatitis), H. R. Seddon and H. G. Belschner (*Agr. Gaz. N. S. Wales, 41* (*1930*), *No. 6*,

pp. 447–450, figs. 4).—An account of a disease which affects both sheep and goats, but which is much more common in sheep.

Parasites and parasitic diseases of horses, B. SCHWARTZ, M. IMES, and W. H. WRIGHT (*U. S. Dept. Agr. Circ. 148* (*1930*), *pp. 55, figs. 36*).—This circular supersedes Farmers' Bulletin 1493, previously noted (E. S. R., 55, p. 578). The first part, devoted to an account of the internal parasites of horses (pp. 1–34), is followed by an account of the external parasites of horses (pp. 34–54).

Salmon poisoning, B. T. SIMMS, C. R. DONHAM, J. N. SHAW, and A. M. MCCAPES (*Jour. Amer. Vet. Med. Assoc.*, *78* (*1931*), *No. 2, pp. 181–195, figs. 2*).—This is a contribution from the Oregon Experiment Station, presented at the annual meeting of the American Veterinary Medical Association in August, 1930.

It is pointed out that salmon poisoning (E. S. R., 60, p. 774) is a disease of canines associated with infestation with the trigenetic fluke, described by Chapin in 1926 (E. S. R., 55, p. 176) as *Nanophyes salmincola*, and that the causal agent of the disease is unknown. "The mammalian hosts include at least one species of each of the five families of terrestrial carnivores which are indigenous to the Pacific Northwest. The snail host is *Goniobasis plicifera* var. *silicula* Gould. The fish hosts include all genera and species of Salmonidae which occur in the streams of western Oregon. Mammalian hosts void eggs as early as the first or sixth day and as late as the one hundredth to the two hundred fiftieth day after infestation. The snail host can tolerate large numbers of the parthenitae. Apparently healthy salmon and trout may contain very large numbers of metacercariae. Among the mammalian hosts the typical syndrome of salmon poisoning has been observed in Canidae only. . . . The intraperitoneal injection of mature flukes has resulted in a condition similar to salmon poisoning. No satisfactory medicinal treatment has been found. A definite immunity follows from an attack of the disease. No practicable method of immunization has been found."

Diseases of poultry, I. E. NEWSOM (*Colorado Sta. Bul. 372* (*1930*), *pp. 42, figs. 17*).—The subject of hygiene and sanitation are first considered. Then follow accounts of nutritional diseases (pp. 6–9), infectious diseases (pp. 9–32), parasitic diseases due to external parasites (pp. 32–34) and to internal parasites (pp. 34, 35), miscellaneous diseases (pp. 36–41), and poisoning (pp. 41, 42).

Infectious laryngotracheitis of fowls, G. KERNOHAN (*Jour. Amer. Vet. Med. Assoc.*, *78* (*1931*), *No. 2, pp. 196–202*).—A more extended account by the author has been noted from another source (E. S. R., 63, p. 575).

Leukemia in fowls, A. J. DURANT (*Missouri Sta. Bul. 295* (*1930*), *pp. 8, figs. 4*).—In this brief practical summary of information it is pointed out that only within the last few years has leukemia in fowls become known as a disease of economic importance in Missouri. Three per cent of all birds examined at the station have been found to be affected with it. It occurs in two common forms, namely, acute, which kills the birds within a very short period after the symptoms develop, and chronic, in which the birds may live for several months. All breeds of chickens appear to be susceptible to it, and turkeys are here reported for the first time as being affected with leukemia.

The cause is unknown, but it is thought to be a filtrable virus, since an injection of whole blood from infected into healthy birds will reproduce the disease in a large number of cases. It is usually of a chronic nature, characterized by a bright green diarrhea and great enlargement of the liver and spleen. Its prevention should consist in careful culling the year round to remove any visibly affected birds, followed by strict sanitation.

Reference is made to some preliminary experiments at the station in which the feeding of raw liver to a few infected birds indicated pronounced curative results.

Some lesions associated with paralysis, A. M. LEE (*Jour. Amer. Vet. Med. Assoc., 78 (1931), No. 2, pp. 203–210*).—It is concluded that fowl paralysis is not a specific disease but is the result of chronic catarrhal enteritis, with very extensive desquamation of the epithelium of the villi of the intestines and subsequent absorption of toxic products from the digestive tract. It is pointed out that there are other causes of catarrhal enteritis, and that coccidiosis is one common cause in fowls, other causes including intestinal parasites, especially tapeworms, and dietary disorders.

A comparison of the intradermal and agglutination tests for pullorum disease, based on demonstrating the infection in the hatch from reactors, B. H. EDGINGTON and A. BROERMAN (*Jour. Amer. Vet. Med. Assoc., 78 (1931), No. 2, pp. 219–224*).—In the experiments here reported, conducted at the Ohio Experiment Station, it was determined that hens in the group reacting to the agglutination test but not to the intradermal test transmitted *Salmonella pullorum* infection in each of ten hatches. "If the flock had been divided on the basis of the intradermal test only, these hens would have remained in the negative group and would have been a source of disseminating pullorum disease. The hens reacting to the intradermal test but not to the agglutination test failed to transmit the infection to chicks during the hatching period. These observations indicate that the intradermal test, under the conditions of this experiment, was not so satisfactory as the agglutination test in detecting carriers of pullorum disease in mature fowls."

A study of spirochetes in chickens, with special reference to those of the intestinal tract, M. B. K. HARRIS (*Amer. Jour. Hyg., 12 (1930), No. 3, pp. 537–568, pl. 1*).—In a study made at Baltimore it was found that normal adult chickens from Maryland carry spirochetes which are harbored in the ceca and appear to be nonpathogenic. Three distinct types observed are described and designated tentatively as *Treponema caeci-gallorum*, *Spironema caeci-gallorum*, and *Fusi spirochaeta caeci-gallorum*.

A list is given of 67 references to the literature.

Lung flukes of the genus Paragonimus in American mink, F. G. WALLACE (*Jour. Amer. Vet. Med. Assoc., 78 (1931), No. 2, pp. 229–234, figs. 2*).—In the course of studies of the animal parasites of the American mink (*Lutreola vison*) by the Minnesota Experiment Station, the author has found that the lung fluke *P. kellicotti* occurs commonly and is apparently widely distributed, having been found present in 7 of 84 carcasses examined. *P. kellicotti*, like its Asiatic congener *P. westermanii*, uses the crawfish as an intermediate host. The author has succeeded in heavily infecting cats with cysts from the pericardial region of *Cambarus immunis spinirostris*. This being the case, there is little chance for pen-raised animals to become infected, as they are seldom fed these crustaceans, and none of the cases reported have been in animals definitely known to be pen raised. Furthermore, subsequent examinations of 143 carcasses, nearly all young animals bred in domestication, revealed no cases of Paragonimus. For this reason it would be well for mink buyers to insist on strictly pen-raised stock and to have fecal examinations made to determine possible infections.

[Contributions on experimental coccidiosis of rabbits] (*Amer. Jour. Hyg., 12 (1930), No. 3, pp. 624–649; 650–656, fig. 1*).—Three contributions are here presented: **Serological Studies in Experimental Coccidiosis of Rabbits (pp. 624–640) and Immunity in Experimental Coccidiosis of Rabbits (pp. 641–649), both by G. W. Bachman; and Jaundice in Experimental Coccidiosis of Rabbits, by G. W. Bachman and P. E. Menendez (pp. 650–656).**

AGRICULTURAL ENGINEERING

Farm water power, G. M. Warren (*U. S. Dept. Agr., Farmers' Bul. 1658 (1931), pp. II+22, figs. 20*).—This supersedes Farmers' Bulletin 1430 (E. S. R., 52, p. 888). It describes and illustrates a number of typical farm water-power plants and gives practical information on their planning, installation, and maintenance.

Daily river stages at river gage stations on the principal rivers of the United States, M. W. Hayes (*U. S. Dept. Agr., Weather Bur., Daily River Stages, 27 (1929), pp. III+162*).—This is the twenty-seventh of a series of daily river stage reports on the principal rivers of the United States (E. S. R., 63, p. 78), and presents data for 1929.

Public Roads, [February, 1931] (*U. S. Dept. Agr., Public Roads, 11 (1931), No. 12, pp. 237-260+[2], figs. 11*).—This number of this periodical contains the status of Federal-aid road construction as of January 31, 1931, together with the following articles: North Carolina County Road and Finance Survey (pp. 237–246); Truck Operation and Production in Concrete Paving Work, by A. P. Anderson (pp. 247–257, 260); and High-Speed Production on Asphalt Concrete Paving Work, by R. W. Edwards and N. L. James (pp. 258–260).

Studies in reinforced concrete, I–III, W. H. Glanville (*[Gt. Brit.] Dept. Sci. and Indus. Research, Bldg. Research, Tech. Papers, 1930, Nos. 10, pp. VI+37, pl. 1, figs. 17; 11, pp. VI+49, pls. 2, figs. 16; 12, pp. VI+39, pls. 6, figs. 23*).—Three papers are given.

I. *Bond resistance.*—Experiments to determine the influence of the length of embedment and the stress in a bar on the bond resistance between steel and concrete are reported, and a new theory of the distribution of bond stress is developed.

The distribution of bond stress at failure is shown to depend closely on the radial movement of the bar under load and therefore on the stress in the bar, and to be independent of the initial shrinkage stress distribution along a bar. The relation between the bond stress distribution and the length of embedment is independent of the diameter of the bar. For a working stress of 16,000 lbs. per square inch the usual allowance of 40 diameters for length of embedment provides a reasonable factor of safety.

II. *Shrinkage stresses.*—The results of experiments to determine the distribution of shrinkage stress along a reinforcing bar are reported and approximate methods outlined for allowing for the creep occurring during shrinkage in making calculations for shrinkage stresses.

It was found that "the shrinkage stress distribution along a reinforcing bar is such that, proceeding from the end of the bar toward the center, a gradually increasing compressive stress is developed in the bar by a practically uniform bond stress over a length which is short compared with the usual length of reinforced concrete members, depends on the diameter of the bar, and is usually not greater than about 1 ft. Over the remaining central portion there is no bond stress and the steel stress is uniform. The length over which bond stresses are developed at the ends does not depend appreciably on the age of the concrete.

"During the development of shrinkage stresses, creep or flow of the concrete is taking place continuously. The amount of this creep is of the same order as the elastic movement, the exact value depending on the cement employed in the concrete. In calculating the shrinkage stresses in reinforced concrete it is possible to allow approximately for the creep in the concrete by using a fictitious or 'effective' value of the modulus of elasticity of con-

crete. This effective modulus of elasticity varies for the different mixes tested between $3 \cdot 0 \times 10^6$ and $1 \cdot 5 \times 10^6$ lb. per square inch, corresponding to modular ratios of 10 and 20. The values do not vary with the percentage of steel used or appreciably with the age of the concrete up to at least 6 months old, the maximum age for which it has been possible to make calculations.

"To a reasonable approximation, the following formula may be used for calculation of the steel strain due to shrinkage of the concrete in a symmetrically reinforced member:

$$e_s = \frac{s}{\frac{E_s a_s}{E_c' a_c} + 1}$$

in which E_c' is the effective modulus of elasticity (allowing for creep), s is the concrete shrinkage, and a_s and a_c are the areas of the steel and concrete. No serious error will arise if this is taken as 2×10^6 lb. per square inch for all ages." It is demonstrated that some end distortion takes place in reinforced concrete members.

III. *The creep or flow of concrete under load.*—Studies are reported, the results of which indicate that when a plain concrete specimen is maintained under load at constant temperature and humidity, the three factors which produce alterations in length are creep under load, shrinkage, and change in modulus of elasticity.

It is demonstrated that during loading the relation between stress and strain, for concretes of the types tested, departs from direct proportionality by an amount depending on the creep taking place, and therefore on the rate of loading. The true modulus of elasticity is that which would theoretically be obtained with instantaneous loading.

The creep over long periods is shown to be practically proportional to the applied stress within the range of working stresses, and the magnitude of the creep depends on the type of cement used. The more rapid the hardening of the cement, the smaller is the creep for a given age, provided the concrete is stored in air. The creep is also approximately proportional to the quantity of aggregate used. Normal Portland, rapid-hardening Portland, and aluminous cements showed very similar general properties in this respect.

The creep is considerably lower for specimens of Portland cement concrete maintained wet than for similar specimens stored in air, whereas aluminous cement showed the reverse effect.

For reinforced concrete calculations the reduced modulus of elasticity can not be used except as a rough guide. More exact formulas for columns are developed, and it is shown that the use of a reduced modulus of elasticity leads to a value of the increase in steel stress due to creep which may be more than 20 per cent less than the actual increase.

The effect of under-stressing on cast iron and open-hearth iron, J. B. Kommers (*Amer. Soc. Testing Materials Proc., 30 (1930), pt. 2, pp. 368–381, figs. 3*).—Tests conducted at the University of Wisconsin of gray cast iron and open-hearth iron representing, respectively, nonhomogeneous and homogeneous metals are reported.

The more homogeneous open-hearth iron seemed to be susceptible of a lower percentage of strengthening than the nonhomogeneous cast iron—about 10 per cent as compared to a maximum of 31 per cent for cast iron. The results of fatigue and understressing tests on notched specimens are also presented, and the contrasting phenomena observed for open-hearth iron and cast iron are explained.

Elastic behavior of spring materials, M. F. Sayre (*Amer. Soc. Testing Materials Proc., 30 (1930), pt. 2, pp. 546–558, figs. 6*).—This paper reports the results of tests on spring steels and phosphor bronze and also on hard-drawn aluminum alloy wire. These indicate that the elastic limit and the proportional limit do not coincide, and that the true stress-strain line, aside from any plastic flow or hysteresis effects, is curved throughout. Definite quantitative values for the rate of change of modulus of elasticity with stress intensity are given. Figures are also cited which indicate, for certain steel specimens, a marked increase in hysteresis and decrease in modulus of elasticity as a result of temporary overstressing beyond the elastic limit.

Procedure used by the Forest Products Laboratory for evaluating paint service on wood, F. L. Browne (*Amer. Soc. Testing Materials Proc., 30 (1930), pt. 2, pp. 852–870, figs. 5*).—This paper, contributed from the U. S. D. A. Forest Products Laboratory, describes the procedure used by the laboratory for evaluating paint service on wood. Evaluation of paint service in paint tests involves three steps, namely, description of the changes that take place in the coatings during exposure, rating the extent of the changes, and interpretation of their significance in terms of the practical serviceableness of the coatings.

Hiding power measurements in theory and application, A. H. Pfund (*Amer. Soc. Testing Materials Proc., 30 (1930), pt. 2, pp. 878–883, figs. 2*).—In a contribution from Johns Hopkins University, tentative definitions for hiding, hiding power of paint, and hiding power of a pigment are presented. A new "Black-and-White" cryptometer based on these definitions is described, and the usefulness of this instrument for measuring the wet hiding powers for all types and colors of coatings is demonstrated. A precision cryptometer, involving the use of a photoelectric cell in place of the human eye, has been developed. This device, which is extremely sensitive and free from the subjective errors of the human eye, yields precision results of hiding power.

Detonation as affected by mineral lubricating oils, R. O. King and H. Moss (*Engineering [London], 131 (1931), No. 3390, pp. 1–4, figs. 8*).—Experiments are reported which were conducted with a Ricardo variable compression engine operating at a speed of 900 r. p. m. with solutions of lubricating oil in a commercial brand of aviation gasoline having a relatively high antiknock value.

The increase of highest useful compression ratio on the addition of benzol or other antiknock material and the subsequent decrease on the addition of oil were found not to vary greatly over engine speeds of from 900 to 1,500 r. p. m. Results are presented of tests using nickel carbonyl, iron carbonyl, lead tetraethyl, benzol, and various lubricating oils in each case, with heated air supplied in some instances.

As regards the deleterious action of oils on the antiknock values of fuels containing benzol or tetraethyl lead, the results show that oleic acid and olein are most active, mineral oil less so, and rape and castor oils relatively inactive. The effect of dissoved mineral oil on benzol and ethyl fluid was found to be deleterious in all cases. At normal induction temperature the mineral oil is always more deleterious than castor oil to the antiknock property of the fuel, and a beneficial effect is obtained with castor oil dissolved in the ethyl fluid mixture.

The economic advantage of fuels given a high antiknock value by benzol or ethyl fluid is considerably lessened when they are used in supercharged engines without means for abstracting the heat generated by compression of the charge.

Results of a corn harvesting machinery experiment, R. L. Patty and D. E. Wiant (*Agr. Engin., 12 (1931), No. 1, pp. 3–5, figs. 5*).—The progress results of an experiment being conducted at the South Dakota Experiment Station are reported.

With reference to husking rolls, it was found that a roll speed of between 250 and 300 r. p. m. is most desirable. Speed seems to have more effect upon the capacity than any other factor. An angle of from 18 to 20° gives the best results for a stationary husker. A husker roll 36 in. long is long enough for practical purposes. Rolls with a small diameter husk the smaller ears better than do rolls of greater diameter, while the larger rolls are more efficient with the larger ears. A retarder above the rolls is necessary if an efficient job of husking is to be done.

The feeder-belt type gives the highest capacity and should be run at possibly from 50 to 60 ft. per minute. Smooth-surfaced rolls with plenty of pegs husk as clean and shell less corn than rough rolls. A short peg with a sharp edge, such as a screw head, does the most efficient job of husking with the least amount of shelling.

Harvesting cornstalks for industrial uses, J. B. DAVIDSON and E. V. COLLINS (*Iowa Sta. Bul. 274 (1930), pp. 373–394, figs. 18*).—Investigations are reported which were conducted partly in cooperation with the Iowa Engineering Experiment Station.

The results show that the development of industrial uses for cornstalks is dependent, in large measure, upon an adequate supply of raw material at a reasonable cost. Cornstalks, being light and bulky, are difficult to handle, and economical harvesting is essentially a problem of reducing labor. The yield of cornstalks (15 per cent water content basis) varies from 1 to 2 tons per acre. Dry, wind-blown stalks in Iowa may be expected to yield from 0.5 to 1.5 tons per acre. Cornstalks can not be harvested economically by hand. Harvesting with corn binder, husker-shredder, and baler costs about $7 per ton under average conditions. Harvesting by breaking, raking, and baling in the field is a very practicable method, and the cost for average conditions is about $3.55 per ton. Under favorable conditions the cost may be $2.70 or less per ton. Combination machines, consisting of mower, rake, and baler, reduce labor. The harvesting of 236.8 tons at Ames in 1930 cost $2.49 per ton exclusive of machinery costs. A reasonable estimate of the cost of machinery, exclusive of power, is 50 cts. per ton.

The cost of collecting baled stalks in the field and transporting them 8 miles and unloading is about $1.80 per ton. Collecting 236.8 tons of stalks at Ames, hauling them to the station 1 to 4 miles, and loading into cars cost $1.23 per ton. Cornstalks when baled without shredding do not absorb water so readily and tend to store better when piled. The capacity of the baler, however, is increased if the stalks are shredded and the weight of bales is increased. The cost of piling cornstalks was 35 cts. per ton with an inclined elevator.

Measuring hay in stacks, W. H. HOSTERMAN (*U. S. Dept. Agr. Leaflet 72 (1931), pp. II+6, fig. 1*).—Formulas for determining the volume of hay in stacks were developed from studies in cooperation with the experiment stations of 10 Western States. Earlier rules were proved inaccurate. The volume rules are for square, flat-topped stacks $(0.56\times O)-(0.55\times W)\times WL$, for high, round-topped stacks $(0.52\times O)-(0.46\times W)\times WL$, and for low, round-topped stacks $(0.52\times O)-(0.44\times W)\times WL$. In these rules O equals the over (the distance from the ground on one side over the stack to the ground on the other side), W the width, and L the length. The volume of round stacks with circumferences or overs greater or less than those given in the accompanying table can be calculated by the formula $V=(0.04\times O)-(0.012\times C)C^2$, wherein C equals the circumference or distance around the stack at the ground and O the over or distance from the ground on one side over the peak to the ground

on the other side. Usually it is advisable to take two over measurements at right angles to each other and to average them.

The ice well for the dairy farm, J. R. Dawson and A. L. Watt (*U. S. Dept. Agr. Circ. 155 (1931), pp. 12, figs. 5*).—A description is given of the details of construction of the ice well installed at the U. S. D. A. Dairy Experiment Station at Mandan, N. Dak., together with data from observations made over a period of about two years on this well and on a concrete well at the Dairy Experiment Station at Ardmore, S. Dak.

The ice well at Mandan consisted essentially of a pit 8 ft. square and 9.5 ft. deep dug in a well-drained site about 10 ft. from the milk house and having a bottom of 1.5 ft. of coarse stone and gravel. The sides of the pit were lined with cheap, rough lumber; 2- by 4-in. studs were placed upright 2 ft. apart against the dirt sides, and rough 1-in. boards were nailed to these. This construction gives a 4-in. air space, if the dirt walls do not cave in. This air space is good insulation against the soil heat. The lumber was not treated in any way, but after two seasons' use there were no signs of rotting.

Ice wells constructed according to the method employed and material used at Mandan are deemed practical and successful under the temperature conditions prevailing in that section. It is thought that such ice wells are adapted to any locality where winter freezing temperatures are sufficiently low and extend over long enough periods to freeze enough ice in the pit. By being careful to conserve the ice, sufficient ice can be made to last over a period of approximately four months during the summer for ordinary dairy-farm use.

In the two experiments described, lumber was the best material for lining the well. Noninsulated concrete was not suitable as used. Milk, cream, and butter can be successfully stored in the ice well for reasonable periods of time. No offensive odors result when care and cleanliness are practiced. For small lots of cream, precooling with cold running water is not necessary, but it is desirable. For large lots of cream it is advisable to precool with cold water in order to conserve the ice and to bring about more rapid cooling. It is advisable to precool whole milk before storing it in the ice well. The ice well can be made at low cost. The lumber used in the well can be cheap and rough. The house over the pit should be tight and durable, but it need not be expensive.

AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY

Proceedings of the Second International Conference of Agricultural Economists, 1930 (*Menasha, Wis.: Collegiate Press, 1930, pp. XI+1079, pls. 5, figs. 79*).—Included are the minutes, program, and attendance of the conference held at Cornell University, August 18–29, 1930, and noted editorially (E. S. R., 63, p. 601), the constitution of and provisions for the temporary organization adopted, and the following papers presented at the conference: Causes of the International Depression of Agriculture, by M. Sering (pp. 19–39); The Relation of Monetary Conditions to the Agricultural Depression, by E. M. H. Lloyd (pp. 40–51); The German Agricultural Situation, by C. von Dietze (pp. 52–59); Causes of the Agricultural Depression in Great Britain, by R. R. Enfield (pp. 60–72); The Problem of Agricultural Surpluses in the United States, by M. Ezekiel (pp. 73–86); Causes and Probable Duration of the Agricultural Depression, by G. F. Warren, with discussions (pp. 87–122); The Agricultural Depression in East Europe with Special Reference to Poland, by S. Schmidt (pp. 123–133); Some Results of the Post-War Depression on Farm Organization in Canada, by J. E. Lattimer (pp. 134–150), noted on p. 81; Maladjustments in the Agricultural Business of the World, by F. E. Geldenhuys (pp. 151–166);

Some Recent Danish Problems in Agricultural Economics, by E. Jensen (pp. 167–177); Post-War Interrelations Between Agriculture and Business, by L. H. Bean (pp. 178–197) (E. S. R., 64, p. 184); A Summary of State Programs in Adjustment to the Agricultural Situation, by C. L. Stewart (pp. 198–212); Agricultural and Social Legislation in New Zealand, by R. M. Campbell (pp. 213–219); Doctrines Relating to Agricultural Policy for the United States, by J. D. Black (pp. 220–235); Policies in the United States Affecting Agriculture, by H. C. Taylor (pp. 236–245); The Valuation of Farm Real Property for Taxation, by W. H. Dreesen (pp. 246–251); Proposals for Relieving Farmers of Undue Tax Burdens, by B. H. Hibbard (pp. 252–257); Objectives and Methods in the Local Definition of the Extensive Margin in Agriculture, by L. C. Gray (pp. 258–269); The Problems of Land Utilization in the Cut-over Regions of the Lake States, by G. S. Wehrwein (pp. 270–277); Selected Features of the Land Utilization Problem Arising in the Older Settled Regions of the Northeastern United States, by I. G. Davis (pp. 278–283); Population Trends in Relation to Land Utilization, by O. E. Baker (pp. 284–306); Agricultural Economics as Applied Economics, by A. W. Ashby (pp. 307–320); The Economist's Approach to the Agricultural Problem of the United States, by E. G. Nourse (pp. 321–328); Agricultural Economics and the Empire Marketing Board, by G. M. Dykes (pp. 329–335); Science and Technique under Conditions of a Socialist Reconstruction of Agriculture, by N. I. Vavilov [3] (pp. 336–342); The Administration and Control of the International Institute of Agriculture, by A. Hobson (pp. 343–349); The Reconstruction of Agriculture in the Soviet Union, by A. J. Gayster [4] (pp. 350–371); The Application of Economic Research to a Village in Bengal, by L. K. Elmhirst (pp. 372–383); The New Forms of Agricultural Production in Mexico, by P. Gutiérrez-Roldán (pp. 384–391); The Possibilities of Agriculture in U. S. S. R., by G. S. Gordeeff (pp. 392–396); Some Settlement Problems in Australia, by P. Campbell (pp. 397–405); The Process of Socialization of Agriculture in the U. S. S. R., by L. Kritsman [5] (pp. 406–424); The Mobility of Agricultural People, by E. Whittaker (pp. 425–433); Tenancy Problems in Japan, by K. Kobayakawa (pp. 434–439); Farm Wages and Wage Regulation in England and Wales, by G. Dallas (pp. 440–448); The Organisation of Wage Earners in Agriculture, by J. F. Duncan (pp. 449–458); The Comprehensive Farming Survey, by A. N. Duckham (pp. 459–480); Theory of Probability and Economic Research, by O. N. Anderson (pp. 481–508); Agricultural Statistics as a Basis for Agricultural Economic Studies, by D. A. E. Harkness (pp. 509–518); Research in Cooperative Marketing, by H. B. Price (pp. 519–524); Cooperative Marketing in Finland, by K. T. Jutila (pp. 525–533); Cooperative Marketing in the United States, by O. B. Jesness (pp. 534–546); Relation of the Federal Farm Board to Cooperative Marketing, by A. W. McKay (pp. 547–552); Observations on the Cooperative Marketing of Grain by Farmers' Associations in Canada and the United States, by J. F. Booth (pp. 553–565); Wheat Marketing in the United States, by L. J. Norton (pp. 566–576); The Cooperative Marketing of Wheat in Western Canada, by A. Cairns (pp. 577–590); Trends in Livestock Marketing, by P. L. Miller (pp. 591–610); Trends in Marketing Livestock, by R. C. Ashby (pp. 611–618); Economic Factors Affecting Milk Supplies of Large Cities, by H. A. Ross (pp. 619–629); Factors Affecting the Philadelphia Milk Supply, by F. F. Lininger (pp. 630–643); A Survey of Some Public Produce Markets in New York, by F. P. Weaver (pp. 644–658); International Cooperation in the Field of Market Re-

[3] Also Moscow: Lenin Acad. Agr. Sci., 1930, pp. 14.
[4] Also Moscow: Lenin Acad. Agr. Sci., 1930, pp. 32, fig. 1.
[5] Also Moscow: Lenin Acad. Agr. Sci., 1930, pp. 28.

porting, by A. Schindler (pp. 654–664); Crop and Livestock Reporting, by W. F. Callander (pp. 665–680); The Development of Federal Standards for the Certification of Farm Products in the United States, by N. A. Olsen (pp. 681–694); The Purpose and Development of Federal Standards for Certification of Farm Products in the United States, by L. S. Tenny (pp. 695–699); Machine Production and the Price of Wheat, by W. E. Grimes (pp. 700–705); Factors Affecting the Timing of Wheat Price Movements, by E. J. Working (pp. 706–712); Materials for a Theory of Wheat Prices, by H. Working (pp. 713–723); Factors Affecting the Timing of Wheat Price Movements, by R. M. Green (pp. 724–732); Recent Developments in European Grain Imports, by R. Freund (pp. 733–745); World Production and Price of Merino and Crossbred Wool, by H. M. Stoker (pp. 746–761); The Relation of Quality to the Price of Farm Products, by F. V. Waugh (pp. 762–776); Effect of Changes in Daily Prices on the Movement of Farm Produce to Terminal Markets, by H. J. Stover (pp. 777–783); Philippine Agriculture and Its Economic Problems, by F. M. Sacay (pp. 784–792); Types of Farming in Canada, by W. Allen (pp. 793–806); Types of Farming in the United States, by W. J. Spillman (pp. 807–812); Soviet State Farms and Specialization in Agriculture, by J. Anissimoff[6] (pp. 813–840); Results of Farm Management Research in the Northeastern United States, by W. I. Myers (pp. 841–863); Research Investigations on the Livestock Ranches of the United States, by A. F. Vass (pp. 864–884); The National Value of Farm Accounting Data, by J. S. King (pp. 885–891); The Economic Classification of Farms as a Basis of Agricultural Advisory Work, by C. V. Dawe (pp. 892–898); Advisory Work on Farm Management, by A. G. Ruston (pp. 899–922); The Development of Agricultural Economics and of Farm Management in the U. S. S. R., by G. S. Gordeeff[7] (pp. 923–931); Farm Cost Accounting in the United States, by A. Boss (pp. 932–942); Some Results of Cost Accounts on New York Farms, by J. F. Harriott (pp. 943–951); Methods and Results of Research Work on the Efficiency of Human Labor on German Farms, by J. J. W. Seedorf (pp. 952–966); The Organization of Livestock Insurance, by A. Jones (pp. 967–977); Increase in Farmers' Indebtedness in Germany and New Methods of Individual Credit Control, by K. Brandt (pp. 978–983); Agricultural Credit Problems in the United States, by A. G. Black (pp. 984–997); Farm Credit Problems in the United States with Special Reference to Country Banks, by F. L. Garlock (pp. 998–1005); Rural Credit in China, by P. C. Hsu (pp. 1006–1011); Factors Determining the Value of Farm Real Estate in the United States, by E. H. Wiecking (pp. 1012–1024); and The Relation of Various Factors to Foreclosures of Farm Mortgages in the Northeastern United States, by F. F. Hill (pp. 1025–1051).

Agricultural economics charts (*U. S. Dept. Agr., Bur. Agr. Econ., [1929], pp. [128]*).—This is a mimeographed list of charts obtainable as photographs or wall charts on agricultural resources and income; cooperative marketing and purchasing; farm prices, credit insurance, taxes, and population; rural life; land economics; acreages, yields, and production of crops, fruits, and vegetables; number, market receipts, and prices of livestock, dairy stock, and poultry; consumption and prices of livestock, dairy, and poultry products; and farm management.

Pee Dee farm management studies, 1925–1930, W. C. Jensen and B. A. Russell (*South Carolina Sta. Bul. 269 (1931), pp. 80, figs. 13*).—This study is based chiefly on farm management records, obtained by the survey method, of 64 farms growing cotton or tobacco in 1925, 138 in 1926, 138 in 1927, and 84 in 1928. The records of 26 farms producing strawberries in 1927 are also included.

[6] Also Moscow: Lenin Acad. Agr. Sci., 1930, pp. 30, pl. 1.
[7] Also Moscow: Lenin Acad. Agr. Sci., 1930, pp. 14.

The soils, topography, climate, distribution of population, trade and industrial conditions, markets and marketing facilities, and the agriculture of the area are described. Analysis is made of the use of land, crop acreages and yields, labor distribution, kinds and use of capital, expenses, receipts, earnings, and the crop and livestock practices and costs of the farms studied. A plan for a 4-mule cotton-tobacco farm is suggested.

The annual operator's earnings of the 369 cotton-tobacco farms ranged from —$1,745 to $10,340, averaging $1,275 for the 4 years. The average for the best 25 per cent of the farms was $2,931 and for the poorest 25 per cent, $74. The costs for different crops, 1926–1928, ranged as follows: Cotton from 6 to 60 cts. per pound with that of 10 per cent of the farms below 10.1 cts. and 34.4 per cent below 15.1 cts.; tobacco from 5 to 34 cts. per pound with 28.9 per cent of the farms below 10.1 cts. and 76.7 per cent below 15.1 cts.; corn from 41 cts. to $2.50 per bushel with 3.3 per cent of the farms below 51 cts. and 21 per cent below 80 cts.; and oats from 29 cts. to $2 per bushel with 12.5 per cent of the farms below 41 cts. The best farms averaged 6.8 acres of cotton, 3.7 acres of tobacco, 6.5 acres of corn, 2.1 acres of oats, 3.9 acres of hay, and 2.3 acres of other crops per mule, as compared with an average of 22.8 acres per mule for all farms and 20 acres for the poorest farms. The average operator's earnings, 1926–1928, increased from $780 for farms of 25 acres or less to $1,374 for farms of 126 acres and over.

Some results of the post-war depression on farm organization in Canada, J. E. Lattimer (*Sci. Agr., 11 (1930), No. 3, pp. 137–149*).—This paper, read at the Second International Conference of Agricultural Economists (E. S. R., 63, p. 601), discusses the changes in farm organization, acreage and production of wheat, production of dairy products, size of farms, and tenancy in Canada since the war, and the conflict of economic force and the public policy in Canada.

Economic problems of California agriculture (*California Sta. Bul. 504 (1930), pp. 78*).—This is a report to the Governor of California, prepared by the economics staff of the College of Agriculture of the University of California in accordance with a law approved June 19, 1929. The development and recent changes in the agriculture of the State, land utilization, agricultural credit, taxation, marketing, and individual adjustments by farmers are discussed, and recommendations are made regarding State, group, and individual activities.

The agricultural outlook for 1931 (*U. S. Dept. Agr., Misc. Pub. 108 (1931), pp. 91*).—This report is a continuation of the series previously noted (E. S. R., 63, p. 85), and was prepared by the staff of the Bureau of Agricultural Economics, assisted by representatives of the State agricultural colleges and extension services and the Federal Farm Board. The production outlook, carry-over, domestic and foreign demand, market outlook, etc., for the leading agricultural products of the United States, and the status of and outlook for agricultural credit, farm labor, farm wages, and prices of farm machinery and equipment are discussed.

The farm outlook for 1931 (*U. S. Dept. Agr., Misc. Pub. 112 (1931), pp. 16, fig. 1*).—This presents the salient features of the publication noted above.

The outlook for the dairy industry (*U. S. Dept. Agr., Bur. Agr. Econ., 1931, pp. [41], pls. 43, fig. 1*).—The present status of and outlook for the dairy industry including number of cows, production of, demand for, and prices of dairy products, foreign demand and competition, etc., and the readjustments being made by farmers to meet the changing conditions are discussed. The results of research studies of the Department, State agricultural experiment stations, and other boards, councils, etc., of the demand for dairy products are briefly summarized, by commodities.

Survey of the wheat situation, April to July, 1930, M. K. BENNETT ET AL. (*Wheat Studies, Food Research Inst. [Stanford Univ.], 6 (1930), No. 9, pp. [1]+379–420, figs. 8*).—The new crop developments, price movements, international trade, visible supplies and outward carry-overs, and the outlook for the new crop year are discussed.

The farm real estate situation, 1929–30, E. H. WIECKING and B. R. STAUBER (*U. S. Dept. Agr. Circ. 150 (1930), pp. 70, figs. 5*).—This circular continues the study of the changes in farm real estate values, ownership and taxes, and farm credit previously noted (E. S. R., 62, p. 573), and covers the year ended March 1 or 15, 1930.

The estimated value per acre decreased 1 per cent for the United States, being +1 per cent in the New England and Mountain divisions, —1 per cent in the East South Central, —3 per cent in the Middle Atlantic and West North Central, and —4 per cent in the East North Central and South Atlantic divisions. There was no change in the West South Central and Pacific divisions.

From March, 1929, to March, 1930, the indexes of farm prices (1909–1914=100) changed as follows: Grains from 124 to 107, meat animals 160 to 151, dairy products 144 to 126, poultry products 144 to 115, cotton and cottonseed 155 to 113, fruits and vegetables 112 to 169, and all groups (30 items) from 140 to 126. The index of retail prices paid by farmers decreased only from 90 to 83.

The average farm returns in 1929 on 11,805 owner-operated farms was $1,298, as compared with $1,334 on 11,851 farms in 1928. The returns per farm increased $149 in the North Atlantic, $8 in the East North Central, and $125 in the South Atlantic divisions, and decreased $114 in the West North Central, $134 in the South Central, and $177 in the Western divisions.

The number of farms per 1,000 that changed hands through voluntary sales and trades increased from 23.5 in 1929 to 23.7 in 1930, through delinquent taxes from 4.7 to 5.1, and through foreclosures, bankruptcy, etc., from 14.8 to 15.7. The East North Central, South Atlantic, and West South Central divisions showed decreases in voluntary transfers and the Pacific divisions in involuntary transfers. Bankruptcy per 1,000 farmers during the year ended June 30, 1929, was 0.78, as compared with 0.89 the previous year.

Taxes on farm property in 1929 were 267 per cent of those in 1914, as compared with 263 per cent in 1928, an increase being shown in each geographic division. Both the farm mortgage loan situation and the credit situation, as reflected in the condition of country banks, were less favorable than in 1928. The net outflow of farm population in 1929 was estimated at 619,000 persons, an increase of 21,000 over 1928 and 15,000 over 1927.

Cost of public education from viewpoint of agriculture in Larimer County, Colorado, G. S. KLEMMEDSON (*Colorado Sta. Bul. 368 (1930), pp. 66, figs. 21*).—The organization, enrollment, attendance, assessed valuation, tax assessments, indebtedness, etc., of the schools of the county are described. The expenditures and inequalities in costs and quality of education supplied in the different school districts of the county are analyzed and suggestions are made for improvement of conditions. The study was made in cooperation with the Bureau of Agricultural Economics, U. S. D. A.

School financing in Michigan, F. M. THRUN (*Michigan Sta. Spec. Bul. 212 (1931), pp. 79, figs. 8*).—The public school system of Michigan and the need for equalization of the school tax burden are described. A plan for equalization is outlined and the four problems of such a plan—a measure or index of the relative cost of a uniform quality school program in all districts, the quality of the educational program, the means of providing equalization, and the safe-

guards to prevent undue expansion as the result of equalization aid—are discussed and the essential steps of the equalization plan summarized.

An appendix includes a table showing the aid under existing laws and the equalization aid to different school districts of the State necessary to equalize a $1,200 per classroom unit minimum program above local tax rates of 4 and 5 mills.

Questions and answers (*Fed. Farm. Bd. Circ. 1 (1930), pp. III+9*).—Brief answers are given to the general questions most commonly asked concerning the activities of the Federal Farm Board in administering the Agricultural Marketing Act. Questions pertaining to the marketing plans for particular farm crops are not included.

Newer truck crop area studies: A preliminary economic report, W. C. Jensen and C. Gunnells (*South Carolina Sta. Circ. 45 (1931), pp. 31, figs. 4*).—This preliminary report has special reference to the Williston, Bamberg, and Fairfax areas, from each of which 40 detailed farm records were obtained. The importance and trends of truck production in the State are described and the farm organization and management, crop production, marketing practices, and the reasons for the variations in earnings in the three areas are discussed. Suggestions are made for plantings in 1931 on 4-mule farms in each area.

The average operator's earnings in 1929 on the 40 farms and the 10 best farms in each area were: Williston, $1,283 and $2,837; Bamberg, $1,822 and $4,743; and Fairfax, $286 and $2,210. The percentages returned on capital were: Williston, 3.4 and 6.5; Bamberg, 4.2 and 11.4; and Fairfax, —2.7 and 5.9.

The milk supply of the New Jersey metropolitan market, C. B. Howe (*New Jersey Stas. Bul. 515 (1930), pp. 24*).—This study, made in cooperation with the Dairymen's League Cooperative Association, Inc., and the Bureau of Agricultural Economics, U. S. D. A., is one of the series previously noted (E. S. R., 64, p. 90) on marketing fluid milk in New Jersey. Tables are included and discussed showing the volume of sales by type of product, county, State of origin, type of dealer, and means of transportation in the New Jersey metropolitan market; the State of origin and volume of sales by type of dealer in the rural market; volume of business in the north shore market; production of milk in each of 13 New Jersey counties; and the per capita consumption of different grades of milk and cream and ice cream in each of the three markets.

The data cover approximately the year beginning October, 1928, and were obtained by visits to 88 specialized dealers and 403 dealer-producers in the metropolitan district, 81 specialized dealers and 223 dealer-producers in the rural market, and 27 specialized dealers and 17 dealer-producers in the north shore market.

The foreign type cheese industry in Wisconsin, W. B. Silcox and H. H. Bakken (*Wisconsin Sta. Research Bul. 103 (1930), pp. 36, figs. 8*).—This study, made in cooperation with the U. S. Department of Agriculture, covers the operations, 1925–1927, of 225 factories manufacturing Drum Swiss, Block Swiss, Brick, Münster, and Limburger cheese. The development of the industry, production, business organization, management and operation of factories, general practices in the industry, and marketing are described. The value of whey cream, factors affecting type of cheese manufacture, yield of cheese, manufacturing costs, prices paid patrons for milk, and problems of the industry are discussed, and suggestions are made for improving the condition of the industry.

Statistics and charts of the poultry and egg industry, compiled by E. R. JOHNSON (*U. S. Dept. Agr., Bur. Agr. Econ., 1930, pp. [1]+83, figs. 38*).—Prices, production, marketing, cold storage, exports, and imports of poultry and eggs are covered.

Factors affecting the price of fresh first eggs at New York, 1919–1928, G. L. JORDAN (*Poultry Sci., 9 (1930), No. 5, pp. 283–290*).—The results of four multiple correlation studies are included. The factors used in the first study were (1) the price of "fresh firsts" at New York City, by months, 1919–1928, corrected for variations in the purchasing power of money, using the index of general price level computed by the Federal Reserve Bank of New York; (2) monthly receipts during the period at New York, Boston, Philadelphia, and Chicago; (3) storage holdings on the first of the month of shell eggs in the United States; (4) storage holdings of frozen eggs in the United States on the first of the month; (5) composite index of wages of the Federal Reserve Bank of New York corrected for the variations in the purchasing power of money; (6) index of total employment in the United States of the Federal Reserve Bank of New York; and (7) the population of the United States.

In the second study factors Nos. 5, 6, and 7 were omitted, and storage holdings of frozen eggs were used only for the months of May to December, inclusive. In the third study the same factors were used as in the second, but the regression and correlation coefficients, standard errors, and standard deviations were worked out for each month. The same factors were used in the fourth study, except that the Bureau of Labor index of wholesale prices was substituted for the Federal Reserve Bank's index of general price level. The average standard errors for the 12 months in the respective studies were 3.41, 2.7, 2.17, and 1.71 cts. The coefficients of correlation for the different months in the fourth study varied from 0.467 for May to 0.981 for August.

The fruit and vegetable supply for fifteen cities, 1929, D. M. JAMES (*Penn. Dept. Agr. Bul. 493 (1930), pp. 82, figs. 3*).—Included are tables showing the monthly receipts, 1929, total and by origin, of the car lot unloads of different fruits and vegetables at 15 Pennsylvania cities, and the total receipts of the 15 cities of different important fruits and vegetables, by commodity and by State of origin, by years 1923–1929, inclusive.

Consumer demand for apples in Michigan, H. P. GASTON (*Michigan Sta. Spec. Bul. 209 (1931), pp. 50, figs. 13*).—This bulletin reports the results of a study of the source and nature of the apple supply of Detroit and other Michigan cities and towns; the present and probable future disposition of the Michigan crop; the types of apples demanded by retailers, hotels, restaurants, pie factories, independent retailers, chain stores, and produce dealers and the nature of the demand; and factors influencing the sales to consumers.

The data show that while 50 per cent of the commercial apple crop of Michigan is shipped out of the State, only about 21 per cent of the Detroit supply is grown within the State. The proportion of Michigan apples consumed outside of the Detroit area is somewhat larger. The demand for A grade or better fruit in Detroit constitutes about 80 per cent of the total demand of that city. It is estimated that at least 75 per cent of the demand of Michigan consumers is for a product which only a small percentage of the growers of the State produce, pack, and market. The average Michigan orchard is composed of varieties of which less than 50 per cent are readily salable, and only 25 to 30 per cent of the commercial crop grown and packed meets the A grade specifications. Of the car lot shipments to Detroit, 1926–1928, Jonathan averaged 23.2 per cent, Winesap 19.7 per cent, and Rome Beauty 10.5 per cent.

More than 50 per cent of the purchases of consumers were for eating out of hand. The greatest demand was for apples from 2½ to 2¾ in. in diameter, there being little demand for apples under 2¼ in., even if of high grade. The most common unit of sale was 25 cts., and sales fell off rapidly when the price exceeded 3 lbs. for 25 cts. The factors influencing sales in the order of their importance were quality, color, size, price, freedom from bruises, variety, and freedom from insect injury. Only 16 per cent of the consumers specified variety in making purchases, 28 per cent asking for "eating apples," 15 per cent for "cooking apples," 22 per cent indicating the ones desired by pointing, and 10 per cent specifying "like obtained before."

Marketing the commercial crop of early potatoes, J. W. PARK (*U. S. Dept. Agr. Circ. 149 (1931), pp. 44, figs. 16*).—The production, market outlets, transportation charges, prices, varieties of potatoes grown, etc., in the leading early potato sections of the United States are described. The factors affecting prices, methods of handling and marketing early potatoes in the more important districts, and the conditions existing in the New York City, Chicago, Philadelphia, and St. Louis markets are discussed.

Farmers build their marketing machinery (*Fed. Farm Bd. Bul. 3 (1930), pp. [1]+1+59, figs. 13*).—Information is given concerning the national sales agencies—Farmers' National Grain Corporation, American Cotton Cooperative Association, National Livestock Marketing Association, National Wool Marketing Corporation, National Pecan Marketing Association, National Bean Marketing Association, and National Beet Growers Association—established by the farmers' cooperatives with the assistance of the Federal Farm Board. The bulletin deals with the organization and marketing plans of these agencies, territories covered, membership, operation and loan policies, and volume of business. The headquarters of the nationals, branch offices, and member cooperatives are listed, and the names and addresses of the seven advisory commodity committees are included.

Farmers' experiences and opinions as factors influencing their cotton-marketing methods, T. B. MANNY (*U. S. Dept. Agr. Circ. 144 (1931), pp. 63*).—The data in this study were collected through interviews, using a schedule, from 176 members of cooperative cotton marketing associations, 85 ex-members, and 280 nonmembers in Alabama, and from 190 members, 143 ex-members, and 207 nonmembers in North Carolina. Tables are included and discussed showing by States for the 3 groups the tenure, use of production credit in 1929, acreages in farms and in cotton, schooling, membership in social clubs and churches, staple grown, changes in kind of cotton grown and methods, use made of county agricultural agents and opinions as to the value of such service, experiences with and opinions of private marketing agencies, sources of and difficulties in obtaining credit and the influences exerted by lenders on marketing, attitude of townspeople toward cotton growers' problems, length of membership in the cotton marketing associations, reasons for and advantages of membership, criticisms of the associations, forms of pooling preferred, reasons for ex-members leaving and nonmembers not joining an association, etc.

The environmental and psychological factors bearing upon membership relations are discussed, and suggestions are made for associations, members, nonmembers, and the agricultural extension services as to means of improving the attitude toward the cooperative associations.

Proceedings of the annual meeting of the New England Research Council on Marketing and Food Supply . . . 1930 (*Boston: New England Research Council [etc.], [1930], pp. [70], fig. 1*).—Included are the minutes and

program of the meeting held at Boston, November 6 and 7, 1930; the annual reports of the secretary, of the activities of the New England Crop Reporting Service, and of the New England Radio Market News Service; the reports of the committees on research in the economics of the New England dairy industry, on crop reporting, on research in the economics of the vegetable industry in New England, and on the tabulation of the 1930 census; and the following papers: The Comparative Advantage of New England and the Middle West in Producing Milk and Cream, by E. Rauchenstein; Demand Studies, by L. P. Jefferson; Demand Surveys, by R. B. Corbett; The Relation of Quality to Price, by L. A. Bevan; The Relation of Quality to Prices, by C. M. White; and The Relation of Market Quality of Food to Value for Consumption Purposes, by M. D. Sweetman.

Farm trade centers in Minnesota, 1905–29, C. C. Zimmerman (*Minnesota Sta. Bul. 269 (1930), pp. 70, figs. 12*).—This study in rural social organization describes the farmers' trading facilities in Minnesota about 1905, and traces and discusses the changes in the trading centers from 1905 to 1930, with particular reference to changes in communication, standards of living, and merchandising methods. It is based chiefly on Bradstreet's Book of Commercial Ratings of Bankers, Merchants, Manufacturers, etc., and data from the League of Minnesota Municipalities. The outstanding characteristics of the changes were as follows:

"(1) The development of the extensive trade centers or major farm retail trading towns was an addition or an extension of a shopping goods trading area upon a larger number of elementary farm trade centers. It was not a substitution of one trade area for another.

"(2) The total process gave a division of labor between retail trading communities and greatly increased the complexity of rural social organization. The elementary trade center still tends to keep much of its centralization of interests and its simplicity, but the competitive shopping areas are confused and fluctuating. Further, the total retail trading organization of the individual farm is much more complex and decentralized than it was before this development of 'market basket' agriculture.

"(3) The farm family has yielded to this confusion of social contacts brought to bear upon it and is losing some of its hold upon the individual members. The elementary agricultural trading centers added to the strength of the farm family as a social organism, the extensive trading centers tend to break down the cohesion between members of the family and between families in the same area. The same differences seem to appear between the trading relations of the elementary center and the major extensive centers as appears generally between the retailing organization of the country and the city.

"(4) This development of contemporary retail trading relations in the country districts came about primarily because of two factors—changes in transportation and changes in the material standards of living of the farm families. These two processes went on together. Which was cause and which was effect is not known. . . .

"(5) The changes in the trading relations of agriculture were associated with two major changes in the farm standards of living," (*a*) an increase in the luxuriousness of the material standards of living, and (*b*) a tendency for the nonmaterial phases to now stay constant or decline with the rapid improvements in material standards.

The study suggests that the isolated type of farm elementary trade center form of social economy is closely related to the isolated or pure village type.

A table is included comparing the following items in the social life of the farm village, elementary trade center, and "rurban" trade center forms of organization: Primary mental unit of personal organization, primary economic unit of organization, group life, collective enterprises, observance of custom, mental stability of the population, religious life and philosophical outlook, attitudes regarding nationalism, mobility and heterogeneity of population, standardized birth rate, standardized death rate, reproduction rate, material standards of living, and psychological or spiritual standards of living.

The elementary trade center form of organization emphasizes the family as a social unit, the individual farm as an economic unit, high birth rate, a low death rate, a high reproduction rate, a fair respect for custom and progress, fairly high material and cultural standards of living, and the preservation of a well-balanced mental life of the people. The other types tend to create extremes of one kind or another.

Agenda of the Thirteenth International Co-operative Congress (*London: Internatl. Coop. Alliance, 1930, pp. 188, pl. 1*).—Included are the program of the congress held at Vienna, Austria, August 25–28, 1930, list of committees, standing orders, and general regulations of the congress, the report of the central committee on the work of the alliance, 1927–1929, proposed amendments to the rules, propositions sent in by societies for consideration, and the following papers: The Marketing, Pooling, and Financing of Co-operative Productions in Relation to the Consumers' Movement, with appendixes, by T. Allen (pp. 137–154); The Canadian Wheat Pool, by A. Cairns (pp. 155–167); and The Principles of Rochdale Co-operation and Modern Systems of Credit Trading, with appendix, by V. Klepzig (pp. 169–188).

The population of Iowa: Its composition and changes, W. L. Harter and R. E. Stewart (*Iowa Sta. Bul. 275 (1930), pp. 63, figs. 42*).—This study, made in cooperation with the Bureau of Agricultural Economics, U. S. D. A., deals with the changes in the composition and character of the population of Iowa from 1850 to date. The growth of the population; the changes in number and distribution of native and foreign born and of urban and rural population; intercounty and interstate migrations; sex, age, and marital distribution of the population; size of families; dwelling facilities; birth rate; death rate; school attendance; and college and high school education of the population are discussed.

From 1856 to 1925 the percentage of the population born in the State increased from 18.4 to 72.1, the foreign born decreased from 16.5 to 8, and the persons born in other States decreased from 65.1 to 19.9. Less than half of the population in 1925 in four-fifths of the counties were born in the county of residence. Rural population decreased from 76.6 per cent of the total in 1870 to 41.6 per cent in 1930. From 1900 to 1930 the rural population decreased 234,559 and the urban population increased 472,605. Only 14 of the 80 cities of 2,500 or over population showed decreases in population from 1920 to 1930, decreases occurring in only 2 of 35 cities of 5,000 population or over. In the villages 301 of the 500 with population less than 500 and 186 of the 337 with from 500 to 2,500 population showed decreases. The farm population in 1920 constituted 41 per cent of the total population, with from 49.4 to 45.5 per cent of that in the age groups less than 20 years of age; the village population constituted 22.9 per cent, with from 20.3 to 21.7 per cent in the age groups less than 45 years of age; and the urban population constituted 36.1 per cent, with from 30.3 to 33.5 per cent in the age groups less than 20 years of age.

In 1920 the percentages of children attending school were as follows: Age 7 to 20 years, United States rural 68.3 and urban 67.9, and Iowa rural 72.6 and urban 71.9: and age 7 to 13 years, United States rural 87.6 and urban 94.4,

Understanding the community, C. R. Hoffer (*Amer. Jour. Sociol., 36 (1931), No. 4, pp. 616–624*).—The ideas essential to a sociological definition of "community," the forces the net result of which causes variations in the characteristics of communities, and the differences between the definitions of a neighborhood and a community are discussed. Knowledge of the necessary number of people for any type of community activity, of the changes affecting the stability of the community, of what cultural interests the people have had, and of the interrelation of the various community activities is held to be essential in arriving at an understanding of a community.

Services of institutions and organizations in town-country communities, C. R. Hoffer and M. Cawood (*Michigan Sta. Spec. Bul. 208 (1931), pp. 37*).—This bulletin is based on records kept by local cooperators in 10 town-country communities of meetings, other than committee meetings, fortuitous or chance meetings, and meetings provided for by law, held during the year ended September 30, 1928. Tables are included and discussed showing the number of meetings and attendance, total and by community, type of agency sponsoring meetings, and age and sex groups of attendants; the nature of programs in different types of meetings; attendance and participation of residents and nonresidents, etc.

A total of 12,860 meetings with an attendance of 826,145 persons were held. The indexes of effectiveness (total attendance divided by estimated population) varied from 19.5 to 35.2 in the different communities. Size of community did not appear to be a factor affecting this index. There were approximately 3.5 times as many meetings designed for men as for boys and 5 times as many for women as for girls under 15 years of age. Residents of the communities participated in programs approximately 3 times as often as nonresidents. The attendance of country people was 15.5 times the estimated population of the trade areas, and that of town people 40.5 times the population of the towns.

Public health and educational services in Michigan, C. R. Hoffer (*Michigan Sta. Spec. Bul. 207 (1931), pp. 34, figs. 6*).—This is the second bulletin of the series previously noted (E. S. R., 60, p. 488). The study is primarily statistical and was made to ascertain the availability of medical, health, library, and school services and facilities, to compare the conditions in rural and urban sections, and to point out considerations pertinent to extending these services to rural districts. The table following shows the services and facilities in rural and urban counties:

Medical, health, library, and school services and facilities in rural and urban counties in Michigan

Service or facility	Percentage of rural population in counties			State
	75–100	50–74	Less than 50	
Number of persons per—				
Physician	1,072	1,076	1,065	1,044
Dentist	3,974	2,969	2,250	2,465
Hospital bed	767	550	246	192
Public-health nurse	28,335	16,083	12,454	14,117
Public libraries—				
Volumes per capita	0.50	0.75	0.62	0.62
Book circulation per capita	1.07	2.22	1.63	1.63
School population enrolled in—				
Schools ... per cent	60.2–92.8	61.7–89.3	50.9–87.5	70.0
High schools ... per cent	11.4	12.6	12.5	12.5
Farms adjacent to—				
Hard-surfaced or graveled roads ... per cent	41.6	49.6	47.1	46.4
Improved dirt roads ... per cent	20.4	14.8	18.0	18.1
Unimproved dirt roads ... per cent	36.0	23.9	32.7	34.4

The services and facilities in towns of different sizes; costs of hospital, public nursing, and library services; and changes in population, 1910–1920, in towns of different sizes are discussed briefly.

The master farmers of America and their education, O. S. Hamer (*Iowa Univ. Studies Ed., 6 (1930), No. 2, pp. 151*).—This study was made to discover, from the activities in which master farmers engage, the need for education of farmers and the best type of education; to consider to what extent education as obtained in and outside of schools seems to have been a factor in the success of master farmers; and to ascertain the facts and influences most potent in developing an intelligent, successful, and happy farm population. It is based on an analysis of the replies from 389 master farmers and 365 wives of such men in 26 States to a questionnaire covering age, farming experience, education from schools and outside sources, previous occupations, acreage operated, type of farming, length of working day, net and gross incomes, amount and sources of property, membership and activity in organizations, hobbies, occupations of father, brothers, and sisters, influences affecting choice of farming as an occupation, and number, ages, education, and vocations of children, etc.

The findings are discussed briefly.

AGRICULTURAL AND HOME ECONOMICS EDUCATION

The public and nonofficial organization of agriculture in the different countries, I (*L'Organisation Publique et Libre de l'Agriculture dans les Divers Pays. Rome: Inst. Internatl. Agr., 1930, vol. 1, pp. 208*).—This, the first volume of a handbook describing briefly and in French the organization of official and nonofficial agencies for the promotion of agriculture, deals in turn with French West Africa, Algeria, England and Wales, Bulgaria, Denmark, Scotland, Egypt, the Irish Free State, the United States, Finland, the Philippines, French Indo-China, Italy, Latvia, Lithuania, Madagascar, Norway, and Poland.

History of agricultural education in Ontario, A. J. Madill (*Toronto: Univ. Toronto Press, 1930, pp. 264*).—The beginnings and development of agricultural education in the Province in the schools connected chiefly with the department of education are described, special attention being given to the progress in the ordinary elementary and secondary schools. Some consideration is given to the development in the early Indian mission schools, the early normal school, the university, and some special schools.

The organization of agricultural education and advice in Germany [trans. title] (*Aussch. Untersuch. Erzeug. u. Absatzbed. Deut. Wirtschaft, Verhandl. u. Ber. Unteraussch. Landw., 14 (1930), pp. VI+98*).—This report of the subcommittee on agriculture of the committee for the investigation of the conditions of production and sale in German agriculture discusses the organization of the elementary high schools and professional agricultural schools and the organizations for giving advice on agriculture.

Vocational education in the United States (*U. S. Senate, 71 Cong., 3 Sess., Doc. 309 (1931), pp. [2]+30*).—This study is based upon researches of the Federal Board for Vocational Education and the President's Employment Commission. It sets forth the program of cooperation of the Federal Government with the States in vocational education in agriculture, home economics, and trades and industry, commercial education, and vocational rehabilitation.

Prospects for progress in home economics education, L. T. Hopkins (*Jour. Home Econ., 23 (1931), No. 2, pp. 117–123*).—The changes taking place in the family as a social institution, the fundamental bases of family life, and the opportunities of home economics education in meeting the present needs are discussed.

Elementary and secondary school education for home and family life, A. E. Richardson (*Jour. Home Econ., 23 (1931), No. 3, pp. 229–233*).—This is the tentative report of the subcommittee on education for home and family life presented to the committee on family and parent education of the White House Conference on Child Health and Protection in November, 1930.

Objectives of school courses in home relationships (*Jour. Home Econ., 23 (1931), No. 3, pp. 238–243*).—Included are the following papers, one presented at the conference on home economics education called by the United States Commissioner of Education, November 10 and 11, 1930, and the other at the meeting of the department of elementary and secondary schools of the American Home Economics Association, held at Denver, Colo., in June, 1930: Objectives for High School Courses in Home Relationships, by M. E. Turner and M. M. Hall (pp. 238–242), and Minimum Essentials for Home Relations Courses in Junior and in Senior High Schools, by E. E. Pirie (pp. 242, 243).

FOODS—HUMAN NUTRITION

Baking flour mixtures at high altitudes, M. W. Peterson (*Colorado Sta. Bul. 365 (1930), pp. 180, figs. 17*).—The report to date of an extensive investigation on the effect of high altitudes on baked flour mixtures is presented in two parts dealing, respectively, with the technical phases and practical applications of the problem. Part 1 contains a brief review of the literature concerning the effect of varying altitudes on flour mixture products; a preliminary discussion of the principles involved in the action of varying atmospheric pressures upon flour mixtures; a description by J. H. Scofield of the construction and operation of the altitude laboratory in which the barometric pressure can be changed to correspond to any altitude from below to 14,000 ft. or more above sea level; a discussion of the factors involved in mixing and baking flour mixtures; and detailed reports, with experimental data, of the baking tests which have led to the formulation of the standard recipes given in part 2.

The types of flour mixtures selected for the investigation included mixtures leavened by the expansion of steam, illustrated by popovers and cream puffs; mixtures leavened by carbon dioxide, including baking powder biscuits, muffins, and other quick breads, and butter cakes; and mixtures leavened by the expansion of air, including sponge cakes and angel cakes.

Preliminary baking tests with products representing the different types of expansion were made at localities where the altitudes were 5,000, 7,700, and 11,797 ft. and also at Washington, D. C., practically at sea level. After the completion of the experimental work in the altitude laboratory, the formulas developed were likewise tested at sea level and at 7,000, 9,000, and 11,797 ft.

Each product studied is discussed in considerable detail from the standpoint of ingredients, manipulation, oven temperature, and in some cases utensils.

In conclusion it is stated that the effect of changes in atmospheric pressure due to changes in altitude is similar in all mixtures. "In cakes the framework is formed by the protein of the egg and the flour. The strands are soaked in the sugar solution. The leavening agent furnishes the gas incorporated within the batter. As this expands on heating, tiny bubbles are formed throughout the batter. Then the heat coagulates the protein which holds the sugar solution, forming the structure of the finished product. If this 'setting' takes place when the air bubbles are very tiny the product has a fine, even texture. But if the air expands into large bubbles and ruptures the cell walls before they have 'set,' the holes are larger and the cake is coarse grained. . . . If, then, the strength of the gluten fibers is increased and the

weight of the material to be held, such as sugar and fat, is decreased, this tendency of the cells to rupture is lessened and a finer grained cake results."

In the supplement, or part 2, directions are given for preparing each type of flour mixture and these are followed by recipes for sea level and 3,000, 4,004, 5,000, 6,200, 7,360, 8,500, 9,820, and 11,180 ft. above sea level.

Baking quick breads and cakes at high altitudes: A guide to housewives, M. W. PETERSON (*Colorado Sta. Bul. 366 (1930), pp. 48, figs. 4*).—A reprint of the supplement, or part 2, of Bulletin 365 noted above.

Proximate composition of fresh vegetables, C. CHATFIELD and G. ADAMS (*U. S. Dept. Agr. Circ. 146 (1931), pp. 24*).—This circular is intended to replace that section of Office of Experiment Stations Bulletin 28 (E. S. R., 11, p. 379) dealing with the composition of fresh vegetables. For the present tables many of the data represented in the earlier summary have been used, together with published analyses from many sources and unpublished analyses from various bureaus in the Department, from the Bureau of Standards, U. S. Department of Commerce, and from the California and Maryland Experiment Stations. In general the plan followed is similar to that adopted for the tables on the proximate composition of fresh fruits and fruit juices (E. S. R., 61, p. 89). In addition to common vegetables, many less well-known or newly introduced varieties are included.

The relation between mealiness in potatoes and the amount of potash in the fertilizer, B. NEIL and M. WHITTEMORE (*Amer. Potato Jour., 7 (1930), No. 10, pp. 275–283*).—In this contribution from the Rhode Island Experiment Station, cooking tests are reported on potatoes grown on experimental plats fertilized with varying amounts of potash and different kinds of potash fertilizers. The cooking tests were carried on for four years. During the first year Rural Russet potatoes were used and the other three years the Green Mountain variety. The potatoes were boiled, mashed, baked, and made into Saratoga chips under standardized conditions and judged for mealiness by appearance, breaking with a fork, and feeling when in the mouth.

In general the potatoes grown on plats fertilized with high potash were more mealy when tested boiled, mashed, or baked than those grown on soil of low potash content. The amount of potash had very little effect on the quality of the chips. No differences could be observed in the mealiness of potatoes grown on soil fertilized with muriate or sulfate of potash. Analyses of the potatoes indicated no wide variations in the starch and protein content of the potatoes grown on the different soils.

The effect of crude fiber on calcium and phosphorus retention, M. A. BLOOM (*Jour. Biol. Chem., 89 (1930), No. 1, pp. 221–233*).—In an effort to throw more light on the disputed question of the relative availability of the calcium and phosphorus in vegetables and in milk, the possibility that the crude fiber in vegetables might interfere with the utilization of the mineral content was studied by metabolism experiments on rats, using as sources of fiber raw and cooked spinach and ashless filter paper. The basal control diet contained white flour, dried whole milk, butterfat, yeast, cod-liver oil, and spinach ash. In the spinach diets the raw or cooked spinach replaced the spinach ash, and in the diets in which filter paper was used, it was added to the basal diet in amounts in one case to make the crude fiber content equal to that of the spinach diet and in the other 30 times as high. Precautions were taken to have the diets adequate in all respects and to keep the acid-base residue constant.

Each experiment was of 1 week's duration preceded by a preliminary period of 4 or 5 days in the metabolism cage and on the same diet. Two series of experiments were run, in the first of which the rats were 63 days old and in the second 33 days old at the beginning of the experiment.

The retention of calcium and phosphorus was not as good on the spinach as on the low fiber diets, but crude fiber in itself did not appear to be responsible for the difference, for on the diets containing cellulose in amounts equal to the crude fiber content of the spinach the retention of calcium and phosporus was almost as great as on the control diet. In the experiments in which the younger rats were used, more calcium was retained on the diets containing cooked, than on those containing raw spinach. On the spinach diets more calcium was excreted by way of the intestines than on the control diet, although the pH of the diet remained essentially unchanged. This was not true of phosphorus nor was it true of either calcium or phosphorus in the older rats.

On the filter paper diets the percentage of phosphorus in the feces in both groups and of calcium in the older animals was approximately the same as for the animals on the low fiber diet. The younger rats on the filter paper diet excreted a greater proportion of their total calcium output through the intestines than those on the control diet, but a much smaller percentage than those on the spinach diet.

"The low retention from the spinach is not due, therefore, to any unsuitableness in the ash, nor to the cellulose as such, but to some other characteristic of the spinach calcium and phosphorus, such as their state of combination, lowering their availability."

Hemoglobin maintenance and production upon synthetic diets, including modifications in the ethyl xanthate and Biazzo methods for copper analysis, I, D. L. DRABKIN and C. S. WAGGONER (*Jour. Biol. Chem., 89 (1930), No. 1, pp. 51–75, figs. 7*).—This paper reports in detail the investigation, noted from a preliminary report (E. S. R., 62, p. 190), leading to the conclusion that the specificity of copper in hemoglobin formation is questionable. The paper should be consulted in the original for details concerning modifications in the Biazzo and potassium ethyl xanthate methods for the determination of copper, and for the controversial discussion of the papers from the Wisconsin laboratories which have led to the general acceptance of the view that copper is specific in hemoglobin synthesis.

Does the nickel dissolved from the container during pasteurization catalyze the destruction of the vitamins of milk? A. D. PRATT (*Jour. Nutrition, 3 (1930), No. 2, pp. 141–156, figs. 3*).—The possibility that nickel dissolved in milk during its pasteurization in nickel containers may catalyze the destruction of the vitamin present in milk was tested for vitamins A, B, and C by comparisons of raw milk, milk pasteurized in glass, and milk pasteurized in nickel containers, respectively, as sources of these vitamins in feeding experiments. The results obtained are summarized as follows:

"There was no appreciable destruction of vitamin A by pasteurization in either a glass or a nickel container. The antineuritic factor of the vitamin B complex was partially destroyed by pasteurization, but there was no evidence of a catalysis of the destruction by nickel. Vitamin C was partially destroyed by pasteurization, but nickel did not seem to increase the destruction."

The response of the monkey (Macacus rhesus) to withdrawal of vitamin A from the diet, E. B. TILDEN and E. G. MILLER, JR. (*Jour. Nutrition, 3 (1930), No. 2, pp. 121–140, figs. 7*).—The original purpose of this study was to determine whether monkeys deprived of vitamin A would show any differences from normal monkeys in their resistance to the infectious eye disease caused by *Bacterium granulosis*. The relatively long incubation period of the granulosis infection and the short survival period of monkeys on diets deficient in vitamin A made it impossible to carry out the original plan, but data were secured on the effects of vitamin A deficiency on monkeys.

The basal diet finally adopted for depleting the reserve stores of vitamin A in the monkey consisted of rice 43.5, egg white 100, sucrose 25, aerated butterfat 10, Osborne and Mendel salt mixture 5, and sodium chloride 2 gm. Vitamins B and G were furnished by 5 gm. of dried yeast, and vitamin C by rutabaga or swede juice which was given in 15 to 18 cc. daily doses at first and later cut down to 9 cc. Other slight modifications in the diet were made from time to time.

Eleven monkeys were kept until death on this ration, which was calculated to furnish only from 6 to 12 units of vitamin A a day. Six other monkeys received the same ration with the exception that the butterfat was not aerated, and consequently the diet furnished vitamin A to the exent of from 250 to 700 units per day.

All but 1 of the 6 monkeys on the control ration remained well and gained in weight. The sixth developed a nonfatal dysentery evidently caused by parasites in the intestinal wall. All of the 11 monkeys on the deficient diet died, 10 of colitis, and 1 earlier of an unknown cause. Xerophthalmia did not develop in any case, and on autopsy no evidence was found of sinusitis, mastoiditis, or tongue abscesses. Evidences of slight epithelial metaplasia were present in some site or other in 9 out of 11 of the animals. The entire absence of fat was noted as one of the most striking observations. That monkeys, like rats and other species, may have considerable reserves of vitamin A was shown by the fact that three months elapsed on the deficient diet before any signs of deficiency were noted, and that 1 animal continued well for more than 9 months.

In commenting upon the total absence of eye lesions and infections in other sites common to rats, attention is called to the susceptibility of monkeys to infections of the intestinal tract, and the possibility is suggested that the monkey succumbs to the intestinal condition before other symptoms have a chance to develop. "On the other hand, it may be that in the intestinal condition which immediately preceded death in 10 of the 11 monkeys on the deficient ration, we have the characteristic effect of depletion of vitamin A in this animal."

The question of the identity of a bacterial growth-promoting factor with vitamin B_1, J. G. Davis and J. Golding (*Biochem. Jour.*, *24* (1930), *No. 5, pp. 1503–1506, fig. 1*).—Three commercial peptones known to promote rapid growth of bacteria were tested for vitamin B_1 by the usual rat feeding experiments, with practically negative results. In addition various vitamin B_1 concentrates of the same order of potency for rat protection were tested for their ability to stimulate the growth of the microorganism in question, a lactobacillus. Widely varying results were obtained, some of the extracts proving quite inactive. It is concluded that the bacterial growth-stimulating substance is not identical with vitamin B_1.

The vitamin B_2 content of cereals and the supposed connection between human pellagra and deficiency of this vitamin, W. R. Aykroyd (*Biochem. Jour.*, *24* (*1930*), *No. 5, pp. 1479–1488*).—In further attempts to determine the relation between the epidemiology of human pellagra and vitamin B_2 deficiency (E. S. R., 62, p. 194), studies were made of the vitamin B_2 content of whole millet (*Sorghum vulgare*), whole rice, milled raw rice, milled parboiled rice, whole maize (corn), and maize endosperm. The same technic was followed as in the previous study. Since this had indicated that large amounts of cereal foods are required to supply vitamin B_2, these were not fed separately from the basal diet but incorporated in it, with such modifications of the other constituents as were required to maintain the same ratio of protein, carbohydrate, and fat.

Whole millet was found to be a poor source of vitamin B_2. An amount constituting 50 per cent of the diet produced an average weekly gain of only 8 gm. in comparison with a minimum of 11 gm. for normal increase in weight. All of the samples of rice, both milled and unmilled, were also low in vitamin B_2. No pellagra-like symptoms were observed on any of the cereal diets. The relative order of whole cereals in decreasing content of vitamin B_2, as determined by gains in weight, is given as wheat, maize, millet, and rice. "The cereals as a class are poor sources of vitamin B_2, and wheat, the most potent so far discovered, is low compared with other foodstuffs."

The control rats from each litter which received the basal diet complete except for vitamin B_2 remained stationary in weight and did not develop skin symptoms as consistently as in the previous study. Of 11 negative controls kept on the basal diet for over 12 weeks, 2 only developed symmetrical raw areas on the skin, and 3 died in from 11 to 14 weeks without marked skin symptoms. These animals all showed an unhealthy mangy appearance, with loss of hair around the eyes, followed by swelling and inflammation of the lids. The other controls surviving over longer periods showed, in addition to stunted growth and a very poor condition of the fur, a reddish-brown stain around the urethra. This stain, which did not give the benzidine tests for blood, rapidly disappeared when adequate amounts of vitamin B_2 were fed. Diets containing 65 per cent of maize endosperm and 50 per cent of whole rice, respectively, did not alleviate the symptoms of dermatitis in the two controls developing such symptoms.

In discussing the relation of vitamin B_2 to human pellagra, attention is called to the facts that maize eaters do not suffer from beriberi; that, as noted of Newfoundland fishermen (E. S. R., 64, p. 594), people who subsist for many months on a diet composed chiefly of refined wheat flour deficient in both B vitamins develop beriberi but no pellagra; and that Arab tribes subsisting largely on millet, which shows no marked difference from maize in its content of vitamin B_2, are practically free from pellagra. The possible presence of a toxic photosensitizing substance in whole yellow corn was tested on rats with negative results.

The author concludes that "the distribution of vitamin B_2 in cereals gives no support to the theory that the dermatitis produced in rats by vitamin B_2-deficiency, originally described by Goldberger and Lillie, is the analogue of human pellagra . . . . Whether, apart from its questionable association with pellagra, vitamin B_2 has an important rôle to play in human nutrition is at present uncertain. Populations who eat a diet largely cereal and particularly those subsisting on rice might be expected to suffer from deficiency of the vitamin, which is found in more abundance in expensive foods such as milk, meat, and eggs."

Evidence for the presence of a third factor in the vitamin B complex of yeast, G. Z. Williams and R. C. Lewis (*Jour. Biol. Chem., 89 (1930), No. 1, pp. 275–288, figs. 3*).—By extracting a dry powdered yeast successively with 50, 75, 90, and 95 per cent alcohol, a residue was obtained which was demonstrated to contain a factor essential for normal growth in rats identical with or similar to the factor obtained by Hunt (E. S. R., 60, p. 690), but differing from all of the other growth-promoting accessory substances in yeast described in the literature. In spite of the title of the paper, the authors state that "there is not yet adequate evidence for assuming that this third principle is even a part of the vitamin B complex. Work on this substance, which we are not yet ready to report, suggests that it is a distinct principle, for it seems to be absolutely insoluble in hot or cold water, alcohol, or acids. No successful method for extracting this third factor from yeast residue has yet been reported in the literature."

The toxic effect of fish liver oils, and the action of vitamin B, E. R. NORRIS and A. E. CHURCH (*Jour. Biol. Chem., 89 (1930), No. 1, pp. 437–449, figs. 4*).—The literature reporting occasional toxic effects of cod-liver oils when used as the source of vitamin A in animal feeding experiments is reviewed briefly, and the results are reported of a systematic study to determine the cause of this toxicity.

It was found that some cod-liver oils produce symptoms similar to vitamin B deficiency when fed in relatively large amounts to rats on a diet containing as high as 10 per cent of yeast, but that the toxicity can be counteracted by feeding still larger amounts of yeast. That the toxic effect was not due to excess of vitamin A was ruled out by the fact that there was no correlation between the A content and toxicity of different samples of oil. That excess vitamin D was not responsible was indicated by the failure of additional vitamin D in the form of irradiated ergosterol to produce similar symptoms.

Continued small doses of isoamylamine and of choline in amounts which may be found in cod-liver oil produced similar symptoms which were prevented or cured by additional yeast. It is thought, however, that the effect of yeast is not specific for these two bases.

Observations on the serum calcium, proteins, and inorganic phosphorus in experimental vitamin B deficiency and inanition, V. SCHELLING (*Jour. Biol. Chem., 89 (1930), No. 2, pp. 575–580, fig. 1*).—Data are reported on the content of calcium, proteins, and inorganic phosphorus in the blood of dogs on the synthetic vitamin B-free diet of Karr, as modified by Cowgill (E. S. R., 46, p. 358), and during the fasting period following refusal to eat the vitamin B-free diet.

With one exception where the calcium dropped from 13.6 to 11.5 mg., no significant decrease in the calcium content of the serum occurred during the vitamin B-free period, nor were there any significant changes in the proteins and inorganic phosphorus. In the subsequent fasting there was a decrease in calcium in the advanced state of paralysis when the loss of body weight exceeded 20 per cent. In one animal there was no appreciable change in the proteins, but the phosphates were slightly increased. In another there was a more marked increase in phosphates and a slight decrease in proteins.

Irradiated ergosterol and calcium-free diet: Effect on calcium and phosphorus metabolism, E. WATCHORN (*Biochem. Jour., 24 (1930), No. 5, pp. 1560–1563*).—The previously noted investigation of the effects of massive doses of irradiated ergosterol on the calcium and phosphorus metabolism of rats (E. S. R., 64, p. 396) has been extended to similar balance studies on diets low in calcium and high in phosphorus and vice versa. The Steenbock-Black rachitic diet was used as the basal diet, with the addition of calcium carbonate and inorganic phosphate, respectively. The general technic was the same as in the preceding study, including preliminary, excess irradiated ergosterol, and recovery periods.

The effects of irradiated ergosterol on the group receiving high calcium and low phosphorus were similar to those of the previous study. The rats lost weight rapidly, the food intake was decreased, and the retention of calcium and phosphorus was lowered markedly, with a corresponding increase in urinary calcium. On the calcium-free diet the animals continued to gain weight, the phosphorus retention was unaffected, but there was an increased elimination of calcium by the kidney, thus producing a negative balance. "Such a loss of calcium, in the absence of calcium from the diet, can only mean that it is being lost from the bones or tissues. This action of large doses of irradiated ergosterol has been suggested from time to time by various

workers and apparently exists whether calcium is present in the diet or not. But for the calcification of tissues the large doses of vitamin D are in themselves insufficient and need to be combined with a fairly high calcium intake. The action of irradiated ergosterol in the latter circumstance clearly requires further investigation."

Hypervitaminosis in fowls [trans. title], E. J. King and G. E. Hall (*Biochem. Ztschr., 229 (1930), No. 4-6, pp. 315-322*).—The pathological effects of an overdosage of irradiated ergosterol on fowls are reported and summarized as no abnormal deposits of calcium in the organs, but a weakened deformed condition of the bones accompanied by a decrease in bone phosphatase and also in kidney phosphatase.

Rickets: The comparatively high value of Colorado sunshine in its prevention, H. B. Stein and R. C. Lewis (*Amer. Jour. Diseases Children, 41 (1931), No. 1, pp. 62-70, figs. 3*).—To determine the antirachitic effect of summer sunshine in Colorado, 7 groups of 2 young rats each on the McCollum rachitic diet 3143 were exposed to sunshine daily for a period of about 40 days for lengths of time varying by intervals of 2.5 minutes from 2.5 to 15 minutes each day that the sun shone. At the end of the period the animals were killed and evidences of rickets determined by Röntgenograms and ash analyses of the bones.

Evidence of slight protection against rickets was found in the pair exposed for as short a time as 3.75 minutes daily, and practically complete protection with an exposure of 7.5 minutes daily. From these observations and published reports on the incidence of infantile rickets in Colorado, the authors conclude that "the effective biologic rays of sunlight in June and July are quantitatively of a greater magnitude in Colorado than in any of the other places where the antirachitic effect of sunlight has been studied. We believe that the relative freedom of the atmosphere from moisture and smoke offers satisfactory explanation of the comparatively high antirachitic potency of Colorado sunshine."

The two control rats kept in the dark on the rachitic diet not only developed severe rickets, but showed retarded growth. That this was not due to the rickets per se was concluded from the fact that the animals acquiring the same degree of rickets through too brief exposure to sunlight grew much more rapidly. This is thought to indicate that sunshine has a beneficial effect on growth.

A comparison of the antirachitic effects of winter and summer sunshine in Colorado, R. C. Lewis, G. M. Frumess, and H. B. Stein (*Amer. Jour. Diseases Children, 41 (1931), No. 1, pp. 71-77*).—A repetition, with slight changes in technic, of the above study in the winter months is reported, with the conclusion that there is no marked difference in the antirachitic effect of winter and summer sunshine in Colorado.

Annual variation in the antirachitic radiation from sun and sky in Baltimore, J. H. Clark (*Amer. Jour. Hyg., 12 (1930), No. 3, pp. 690-695, figs. 2*).—The author has modified the method previously described for measuring solar ultra-violet radiation by means of the rate of darkening of zinc sulfide (E. S. R., 62, p. 592) to the extent of conducting the tests simultaneously under white glass and quartz screens of the same thickness and deducting from the calculated values for the quartz, representing wave lengths between 290 and 350$\mu\mu$, those for the glass, representing 315 to 350$\mu\mu$. The resulting values, representing wave lengths of 290 to 315$\mu\mu$, are considered to represent the true antirachitic radiation. Using this modified method, values were obtained for the antirachitic radiation from the sun and sky in Baltimore (readings made

at noon on clear days) from October, 1928, to May, 1930. The values were expressed in ZnS units and in ergs per square centimeter per second. In the latter unit the extreme variations in the antirachitic rays in direct sunlight on clear days were from 400 ergs per square centimeter per second in December to 5,800 ergs in July, or a ratio of 1:14.5. The antirachitic radiation in north skylight on the other hand varied from 300 ergs per square centimeter in December to 2,100 ergs in July, or a ratio of 1:7.

North sky readings made both on clear and on cloudy days showed that the clouds, unless very dense, had little effect on the antirachitic radiation, which was frequently higher on cloudy than on clear days. A greater difference was found between the values of the antirachitic radiations in Boulder, Colo. (as noted in the following paper) and in Baltimore than previously noted for direct solar radiation.

Annual variation of therapeutic radiation from the sun and sky in Colorado, J. R. Earp (*Amer. Jour. Hyg., 12 (1930), No. 3, pp. 696–698, fig. 1*).—With the use of the modified method of Clark noted above, observations have been made of the intensity of the antirachitic radiation of sunlight in Colorado monthly from January, 1929, to January, 1930, inclusive, and of northern skylight for the same months with the exception of June and July.

The range in average intensity of the sunlight expressed in ZnS units was from 0.08 in January to 0.81 in August, with corresponding values for sky shine of 0.05 and 0.16. Sky shine is considered to have advantages over sunshine for heliotherapy on account of its greater constancy not only at different seasons of the year but throughout the day. It is suggested that, although it is too cold in Colorado to use open-air sky shine in winter, in warm climates it may be possible to expose patients to sky shine throughout the year without exposing them to any marked variations in intensity of therapeutic light.

Contribution to the study on the rat of experimental rickets and antirachitic régimes or substances [trans. title], J. Alquier (*Bul. Soc. Sci. Hyg. Aliment., 18 (1930), No. 2–3, pp. 51–85, pls. 5, figs. 8*).—Essentially noted from another source (E. S. R., 63, p. 494).

A comparison of the influence of iodized milk, and of potassium iodide administered directly, on the size and iodine content of the thyroid gland of rats, W. E. Krauss and C. F. Monroe (*Jour. Biol. Chem., 89 (1930), No. 2, pp. 581–588, pl. 1*).—This study was undertaken at the Ohio Experiment Station to determine whether milk iodized through feeding supplemental iodine to cows is harmful or beneficial, and whether it is effective in the treatment of simple goiter. The plan of the study was to feed rats nothing but the milk in question to which had been added sufficient iron and copper to prevent the development of nutritional anemia, and after a definite period (from 8 to 14 weeks in the various series of experiments reported) to kill the animals and determine the size and iodine content of their thyroid glands. The milk tested included normal milk with negative iodine content, milk from cows receiving 0.1 gm. of potassium iodide daily (this iodized milk containing approximately 5 parts of iodine in 10,000,000), the same iodized milk diluted with an equal volume of normal milk, and normal milk with additions of 0.000025, 0.00005, and 0.0000125 gm. of iodine as potassium iodide, respectively.

In general, on the basis of fresh weight of the gland, the administration of iodine to rats either as potassium iodide or combined in the milk resulted in smaller thyroid glands with higher content of iodine. The iodized milk diluted with normal milk gave as good results as when fed undiluted, suggesting that the amount of iodine furnished by the iodized milk was in excess of that required for optimum utilization.

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Curative experiments were also carried out on rats which had developed large thyroids on the Steenbock-Black yellow corn rachitic diet. The administration of iodized milk or potassium iodide resulted in a decrease in the size of the thyroid gland and an increase in its iodine content.

The authors discuss the feasibility of iodizing milk as follows: "Iodizing the general milk supply would insure a constant source of iodine to all persons using milk. It would automatically treat a great many individuals who either through ignorance or lack of funds have had no knowledge of a thyroid deficiency. It would serve as a prophylactic, particularly in young growing children, when an iodine deficiency has not manifested itself in any symptom ordinarily used in diagnosis. Furthermore, the iodine would be furnished in a stable, convenient, and pleasant form. On the other hand, in cases where a constant supply of iodine would be irritating rather than beneficial, some source of ordinary or noniodized milk would need to be available. It is true that putting iodine into milk through the cow is rather wasteful, as only 10 to 15 per cent of the iodine fed appears in the milk, but by such a procedure the cow is also benefited."

Botulism and home canning (*Jour. Amer. Med. Assoc., 96 (1931), No. 10, p. 777*).—In this editorial comment, attention is called to the first outbreak of botulism to be recorded in 1931. In this outbreak resulting in 12 deaths, the causitive food was a salad made from a mixture of home-canned string beans, peas, and carrots. "Heretofore, home-canned string beans have caused outbreaks of botulism far in excess of any other food. Home-canned string beans, even when mixed with carrots and peas, canned by the cold-pack process, are a potential menace to the health. They should always be boiled before being served. Departments of home economics in agricultural colleges, universities, and their extension divisions throughout the country should plan a vigorous educational campaign to prevent these deaths. Unfortunately, many of the recipes for the home canning of vegetables antedate the present-day knowledge of botulism, and with few exceptions no effort has been made to correct them."

A multiple-chamber respiration apparatus for rats and other small animals, F. G. Benedict (*Jour. Nutrition, 3 (1930). No. 2, pp. 161–176, fig. 1*).—The single respiration chamber for rats and small animals previously described (E. S. R., 62, p. 192) has been modified and adapted to a multiple chamber apparatus consisting of four respiration chambers, each with its own spirometer, carbon dioxide absorbent, and rotary blower. This system makes it possible to study four different animals simultaneously. With the establishment after many observations on rats 24 hours after food of an average respiratory quotient of 0.72, it is considered unnecessary to measure the carbon dioxide production, the values being calculated from the oxygen consumption which is determined in periods of about 1 hour in length.

The metabolism of the albino rat during prolonged fasting at two different environmental temperatures, K. Horst, L. B. Mendel, and F. G. Benedict (*Jour. Nutrition, 3 (1930), No. 2, pp. 177–200*).—With the use of the multiple chamber closed circuit respiration apparatus noted above, oxygen consumption measurements were made in periods of from 1 to 4 hours in length on female albino rats of an average age of 200 days during fasting until death. Four rats were kept at an environmental temperature of 26° C. and 4 others at 16°. The rats maintained at the higher temperature lived on the average for 16½ days and lost 49 per cent of their initial body weight, while those at the lower temperature survived for an average of only 11 days and lost somewhat less, 44 per cent, in weight. One animal at 26° lived for 25 days. The length of survival is thought to refute the supposition that small animals succumb quickly to fasting.

The basal metabolism of rats fasting at 26° but measured at 28° was from 600 to 700 calories per square meter of body surface per 24 hours about 24 hours after food. The total metabolism of these rats was at a lower level than that of the group at the lower temperature, which averaged 1,260 calories per square meter of body surface at the twenty-second hour. At the end of the seventh day, the decrease in total metabolism averaged 36 per cent for the group at the higher temperature and 19 per cent at the lower. Per square meter of body surface, the heat production of the group at the higher temperature decreased distinctly to a final level as low as 400 or 450 calories per 24 hours, while that of the group at the lower temperature fell only imperceptibly in 7 days.

It is emphasized that in any metabolism study in which the rat is used as the experimental animal the most reliable measurements from which average or standard values may be derived require periods covering several hours, and that the readings should be made at the critical temperature of 28° rather than at lower temperatures.

MISCELLANEOUS

Forty-first Annual Report of the Kentucky Agricultural Experiment Station for the year 1928, Part II (*Kentucky Sta. Rpt. 1928, pt. 2, pp. [2]+531+8+15+[3], figs. 50*).—This contains reprints of Bulletins 283–290 and Circulars 39 and 40, all of which have been previously noted.

The Forty-third Annual Report of the Maryland Agricultural Experiment Station, [1930], H. J. Patterson (*Maryland Sta. Rpt. 1930, pp. XXII+326+[2], figs. 82*).—This contains the organization list, a report by the director on the work and publications of the station, a financial statement for the fiscal year ended June 30, 1930, and reprints of Bulletins 311–320, all of which have been previously noted.

Thirty-eighth Annual Report [of Minnesota Station], 1930, W. C. Coffey (*Minnesota Sta. Rpt. 1930, pp. 80*).—This contains the organization list, a report of the director on the work and publications of the station, including brief abstracts of articles contributed to outside publications, a list of the station projects, and a financial statement for the fiscal year ended June 30, 1930.

Report of the South Mississippi Branch Experiment Station, [1930], J. C. Robert, W. W. Welborne, and J. L. Cooley, jr. (*Mississippi Sta. Bul. 285 (1930), pp. 32, fig. 1*).—The experimental work reported is for the most part abstracted elsewhere in this issue.

Report of the Raymond Branch Experiment Station, [1930], H. F. Wallace (*Mississippi Sta. Bul. 287 (1930), pp. 20, fig. 1*).—The experimental work reported is for the most part abstracted elsewhere in this issue.

NOTES

Alabama Station.—F. L. Davis has been appointed assistant soil chemist vice W. W. Pate, resigned.

Nevada Station.—Work upon an animal nutrition project involving breeding trouble and malnutrition in cattle and sheep has indicated a deficiency of phosphorus in the majority of samples of the feeds of the State which have been examined. The results promise to indicate methods for alleviating the trouble.

New Jersey Stations.—A gift to the State for administration as a dairy research station has been made of 1,100 acres of crop and pasture land, 270 Guernsey and 55 Holstein cattle, elaborate buildings, and equipment. The donor is James Turner of Montclair, a stockbroker in New York City. The gift was accepted by the State on March 16, arrangements being made whereby the equivalent of the taxes on the property will continue to be available to the townships of Wantage and Beemerville in which the property is located. The estate consists of two farms, one of 700 acres on which $500,000 is said to have been spent for improvements and the other 3 miles distant and containing 400 acres.

It is expected that the new station will begin operations immediately. Four projects are contemplated, dealing with the breeding of cattle for milk production, cattle feeding, control of diseases, and economic management. The residence on one of the farms provides an elaborate administration headquarters, and laboratories and other equipment will be added from time to time. In the words of *New Jersey Agriculture*, "thanks to Mr. Turner's vision and generosity, New Jersey will now have one of the largest and most complete dairy experiment stations in the world."

New York State Station.—A method for clarifying apple cider cheaply and quickly so that a crystal clear beverage can be obtained within 10 to 12 hours after pressing out the juice has recently been developed by the station, and was given its first public demonstration at a recent meeting of the State Horticultural Society. The principle involved in the new process is the introduction of an enzyme which decomposes the soluble pectin in cider without affecting the starches or protein. During the decomposition of the pectin insoluble substances are formed which are easily removed by filtering, together with other substances responsible for the cloudiness of the cider. The use of this enzyme has the advantage over other methods of clarifying cider that it can be added immediately after the juice is pressed and completes its action within 10 to 15 hours.

Tennessee University.—Robert H. Fox has been appointed instructor in entomology.

Washington College and Station.—Henry F. Holtz, associate in soils in the station, died April 20 at the age of 50 years. A native of Wisconsin, he received the B. S. A. degree from the college in 1911 and the M. S. A. degree in 1913. He had been connected with the soils division since graduation, being the one continuing personality in that division for 20 years. His most notable contribution to soil science was his studies on organic matter of semiarid soils. At the time of his death he was engaged in research on the rôle of nitrogen in soil organic matter maintenance and the effect of fertilizer applications on the composition of crops.

EXPERIMENT STATION RECORD

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EDITORIAL

THE PASSING OF JORDAN, COMSTOCK, AND PAMMEL

During the spring of 1931 three more of the ever-dwindling band of pioneers in agricultural education and research in this country passed away. These were Dr. Whitman Howard Jordan, for 36 years director of the Maine and New York State Experiment Stations; Prof. John Henry Comstock, for 40 years head of the department of entomology of Cornell University; and Dr. Louis Hermann Pammel, for 31 years professor of botany and botanist in the Iowa College and Station. All of these men began their work well back in the nineteenth century, and all had retired from active service, but their influence was still potent and pervasive, both within their respective institutions and in the world of science to which they had so amply and so distinctively contributed.

The services of Dr. Jordan were reviewed at some length in these columns at the time of his retirement in 1921 (E. S. R., 45, p. 305). To the discriminating and sympathetic estimate there given, written by Dr. E. W. Allen, little need be added aside from extracts from later tributes and a few biographical details.

Dr. Jordan was born in Raymond, Me., on October 27, 1851. He was an early student of the Maine State College, now the University of Maine, graduating in 1875, and serving there as an instructor in chemistry from 1879 to 1880 and as the director of the Maine Experiment Station from its establishment by the State in 1885 until his acceptance of the directorship of the New York State Station in 1896. Since his retirement he had again made his home in Orono, where he died on May 8.

The mere enumeration of some of the positions which he occupied indicates their pioneer nature. Thus, his brief experience about 1878 as assistant chemist of the Connecticut Experiment Station at Middletown under Dr. W. O. Atwater enrolled him as a member, though in the closing months of this venture as conducted at Wesleyan University, of the first experiment station to be established by formal State action. As professor of agricultural chemistry from 1881 to 1885 in the Penn [illegible] rally broke new ground when half a c[illegible] isive system

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of plat experiments which have since been maintained without interruption, and it was in special recognition of this action that he had been expected to be the guest of honor at the recent commemorative Soil Fertility Conference.

In Maine he began his career as a station director with a total appropriation for maintenance of $5,000 per year, part of which was required for the fertilizer control, and on leaving 11 years later the income was but slightly in excess of $18,000 per year. Yet in spite of resources so restricted that for a time he was "his own stenographer, clerk, bookkeeper, and editor, as well as sharing in the analytical work of the laboratory," he became a recognized leader in the experiment station movement.

As director of the New York State Station, Dr. Jordan devoted 25 years of earnest and able endeavor to its further upbuilding and strengthening along lines which he laid down in his initial report as follows: "The real function of the experiment station is to conduct severe scientific inquiry in those lines related to the practice of agriculture, and, therefore, the controlling policy of this station should be to strengthen and develop its facilities for making such research exhaustive and conclusive."

These were high standards, especially at the time these words were written, but how well he succeeded in maintaining them is attested by an extract from resolutions adopted by the faculty of Cornell University at the time of his retirement: "The outstanding feature of his long service in the interest of agriculture has been his strict adherence to the dictates of science without regard to popular esteem or favor. Strong as the temptation has been for an administrator to popularize the work of his institution at the expense of its research, Prof. Jordan, in his administration of the station, has held strictly to the original purpose and object of the institution uninfluenced by considerations of popular favor."

A similar view is expressed in a final tribute from the staff of the New York State Station. "He believed," it is stated, "that the most useful work an experiment station can do is to conduct rigidly scientific investigations of agricultural problems," and his great influence is pointed out in raising the trend of agricultural science and practice to a high plane by "his insistence upon this fundamental principle and his exceptional ability in expounding it to his colleagues and to the public."

Yet notwithstanding his forceful and unswerving defense of research for its own sake and his unceasing efforts to maintain in the stations an atmosphere favorable to the development of the research spirit without the handicap of distractions that too often beset the research worker, he had full sympathy with the man on the farm and with appropriate efforts to carry the results of research into

everyday practice. One of his earliest innovations in New York was the supplementing of the station bulletins by a series of popular editions, based thereon and given wider distribution. He also took an interest in the preparation of effective handbooks and other compilations, bringing out personally a manual on The Feeding of Animals in 1901 and another entitled Principles of Human Nutrition in 1912.

The influence of such a leader extends inevitably beyond the walls of his own institution or even the boundaries of his State. Dr. Jordan was for 30 years a prominent and distinctive figure in the Association of American Agricultural Colleges and Experiment Stations. He served as its president in 1911 and for 16 years was a member of its executive committee. He will long be remembered as a zealous champion in the general sessions of the interests of the experiment stations, their individuality and essential integrity, and in the gatherings of station directors as an earnest advocate of sound research and high ideals. His services in the association were appropriately referred to in a minute adopted by that body upon his retirement, as follows: "Incisive of speech, careful and wise of judgment, resourceful, always in earnest but never dogmatic, he has been for a generation a tower of strength in our councils as well as a friend whom those of us who have known him might grapple to their souls with hoops of steel."

As Director Hedrick of the New York State Station has said in a recent tribute to Dr. Jordan's memory, "a volume, no small one, might be written of his activities, contributions, ideals, criticisms, and research in agriculture." Yet the whole matter has been well epitomized by Dr. Allen in the following terms: "The period of his activity covers the greatest period of development in the American stations, not only in point of revenue but in the growth of agricultural research. He stood consistently through the formative period of the stations for the high ideals and purposes which these institutions were to express. His voice was heard in no uncertain terms in setting forth these ideals, in defining the nature and essentials of research, in criticism of tendencies he believed to be injurious, and in constructive suggestion."

John Henry Comstock, according to Dr. Howard "the first real teacher of entomology in the United States who carried his work through to a very successful conclusion," was born in Janesville, Wis., on February 24, 1849. Shortly thereafter, the death of his father while en route to the California gold fields led to the return of the family to New York State. Many years of struggle followed for him, including several summers spent aboard ship on the Great Lakes in an effort to obtain funds for winter schooling. Interested

as a boy in botany, a chance search in a secondhand bookstore for a book on mosses and lichens brought to his notice a copy of the historic treatise by Harris dealing with insects injurious to vegetation, and he was led thereby to the study of entomology.

Entering the recently established Cornell University, he took such courses in natural history as constituted the nearest approach to the subject which was available, and spent a summer at Harvard with Hagen. While still an undergraduate he was asked to give a course in entomology to other students, and in this way entered upon his teaching career in the university. Upon graduation in 1874, he was appointed instructor, and in the words of Prof. Essig's recent biographical sketch, "for 40 years thereafter he led to pronounced success the department of entomology of his Alma Mater and made it one of the most celebrated of its kind in America."

Most of this long period of service was spent at Cornell, but it was broken by short intervals of graduate study with Verrill at Yale University and Leuckart at the University of Leipzig, an important 2-year leave of absence as entomologist of the U. S. Department of Agriculture from 1879 to 1881, and a series of lectures and other instruction given during the winter months for about a decade at Stanford University.

As an investigator, Prof. Comstock's chief contributions in economic entomology centered around his work with the Department of Agriculture. Much of it dealt with scale insects, as published in the report of the Commissioner of Agriculture for 1880 and the second report of the Cornell Experiment Station for 1883, in which a large number of new species were described. He also did pioneer work on cotton insects and wireworms. In addition he was well known in the field of general entomology as a prominent authority, according to Essig, "on classification, anatomy, biology, and the wings of insects, and the classification and biology of spiders and other arachnids."

Yet it is as a teacher and writer that he will probably be longest remembered. His influence in these fields has been well set forth in the following obituary tribute in the *Journal of Economic Entomology* by a former student and successor: "His early struggles in self-education unquestionably produced a mental tendency to obtain a clear, precise, logical arrangement of a problem in his own mind, with the result that he always presented his subjects to his students with a similar degree of clearness and conciseness. This quality of Prof. Comstock, together with his infectious enthusiasm and his personal interest in his students, made him a great teacher. Moreover, this quality of mind and thought, together with his experience as a teacher, contributed to his success as a writer of text-

books, exemplified by the Manual for the Study of Insects and the later, more complete work, An Introduction to Entomology."

The distinctive nature of many of his publications deserves special mention, for they were much more than the average compilation. For example, the Manual, first published in 1894 with approximately 700 pages and 800 figures, involved much detailed study and original work. In the preparation of this remarkable series, as in many other ways, he was fortunate in the invaluable assistance of his wife, the late Mrs. Anna Botsford Comstock, who became of wide reputation in her own right for her proficiency in entomological illustration and engraving and also as a writer on bees and nature study. The publications which they collectively prepared proved exceedingly timely and useful, and in the final years of their activity largely occupied their time and attention. Death came to Mrs. Comstock August 24, 1930, and to her husband March 20, 1931. Announcement has recently been made that under their joint wills the bulk of their estate, including the publishing company which they conducted, has been bequeathed to Cornell University, with a provision for the establishment of what will be known as the Grove Karl Gilbert loan fund for self-supporting students. Thus their influence and aid will be characteristically perpetuated in the days to come.

Considerably the youngest member of the trio under review was Dr. Pammel, who died on March 23. Like Prof. Comstock, he was born in Wisconsin, but at La Crosse on April 19, 1862. He obtained the degrees of bachelor, master, and doctor of science from the University of Wisconsin in 1885, 1889, and 1925, resecpectively, began his long service in Iowa 2 years after the passage of the Hatch Act, and did not retire from active service until 1930. Yet in many ways the term pioneer is appropriate in an account of his activities. Some of his earlier life was spent in the traditional log cabin on the prairie farm, his elementary education was correspondingly meager, and he was among the first in the field of botanists in the Upper Mississippi Valley.

After a period as an assistant at Harvard University and the Shaw School of Botany at Washington University and a summer spent at the Texas Experiment Station in a study of root rot of cotton, he succeeded Dr. B. D. Halsted as professor of botany at the Iowa State College and took over the botanical work of the Iowa Station. In the 41 years which followed, his activities covered a wide range. Dean Curtiss has recently characterized him as "a broad-minded, well-trained scientist, whose influence and service extended beyond the scope of his particular field." In addition to

building up from a one-man staff a strong and well-rounded department of botany, now with a personnel of about 20 members and elaborate facilities, he began in 1889 and continued for 15 years the teaching of bacteriology. "He was one of the first, I believe the first to teach bacteriology in a land-grant college," Dr. R. E. Buchanan, the present head of that department, has stated, "and one of the first to demonstrate in his research laboratories the causal relationship of bacteria to plant disease."

Other unique services were rendered in his development of an herbarium of 180,000 sheets, numerous intensive studies of the flora of the plains and Rocky Mountains, the prosecution of a weed survey of about half the State along lines of the soil survey, and comprehensive observations on poisonous plants. Regarding the last-named field, Dr. A. S. Alexander has pointed out in an exceptionally appreciative tribute in the May issue of *Better Crops with Plant Food* that "the veterinary profession was indebted to him for hundreds of instructive articles on poisoning of animals by noxious plants, published in various issues of *Veterinary Medicine* and other journals, and for his magnum opus—A Manual of Poisonous Plants—a standard textbook on the subject." This manual, completed in two volumes in 1911, contained over 1,100 pages, with profuse illustrations, and represented a prodigious amount of labor. A revised edition was under consideration at the time of his death.

Dr. Pammel was also a voluminous writer on many other topics, including taxonomic botany, morphology, ecology, plant pathology, the weeds, grasses, and honey plants of Iowa, conservation, biography, and education. Among his characteristic works was his book entitled Prominent Men I Have Met, which includes chapters on a number of colleagues and other acquaintances.

An early advocate of conservation, he served as the first president of the State Board of Conservation from 1918 to 1927, and is said to have been the author of the Iowa conservation law. He was largely instrumental in the establishment of a series of 36 State parks, an achievement recognized in 1930 in the naming of the Pammel State Park at Winterset in his honor. He was also interested in forestry, and had collaborated with the U. S. Department of Agriculture at various periods and in several phases of forestry and botanical work.

Still another leading interest of his life was education and the promotion of sound scholarship. In 1911 he was elected a charter member of the Iowa chapter of the honorary scholarship fraternity Phi Kappa Phi, and subsequently took a leading part in fostering the ideals and purposes of that organization. He served as its secretary general for a decade, and following a period as president general from 1923 to 1927, he continued to be active in the capacity of

past president general. In the words of a recent tribute in *Phi Kappa Phi Journal*, "in his talks and addresses before many and diverse college groups, Dr. Pammel made a lasting impression upon all those who heard him. His influence upon students and colleagues alike was inspirational, and he never failed to give encouragement to worthy efforts." He was undoubtedly an influential factor in the land-grant colleges as an advocate alike of true scholarship and the importance of science as an element in a liberal education.

As would be expected, the lives of Jordan, Comstock, and Pammel presented great dissimilarities, but there were also not a few things which they had in common. In education and environment, all were products of the early days of the land-grant colleges, and it is rather significant that all were exponents and advocates of sound scholarship and broad fundamental training. All made noteworthy additions to knowledge in their respective sciences, and all wrote books and treatises which helped to popularize their subjects and reduce them to effective pedagogical form. Yet besides these things and many more, the view may be hazarded that in each case their outstanding contribution was personal leadership. Scores of young men passed through the classrooms of Profs. Comstock and Pammel and the laboratories and offices of Director Jordan to become in their turn eminent in the world's work, and many were the entomologists, the botanists, and the administrative officers in other institutions and in the world at large who profited by their aid and counsel.

In these days of relatively ample revenues, large staffs, elaborate buildings and equipment, and overflowing classrooms, it may be idle to speculate on how far the diminution of personal contacts between professors and students, directors and staffs, which seems largely inevitable under modern conditions in the agricultural colleges and experiment stations, counterbalances the material gains over the pioneer days in resources, knowledge, and efficiency helps and methods. Each period has its own conditions and problems, and the prevailing trend is perhaps necessarily toward standardization and uniformity. But however this may be, the outstanding leaders in agricultural science in the past have been prevailingly men of forceful personality, as in the case of this trio. It may be well to pause not only to pay tribute to their memory but to seek to discover the reasons for their success, and to visualize the opportunities for profiting as fully as possible from their achievements and example.

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

[Chemical investigations of the Indiana Station] (*Indiana Sta. Rpt. 1930, pp. 70, 75, 76*).—The work here reported includes the following:

Effect of storage of samples of plant materials on the forms of nitrogen.—The material, consisting of finely ground tomato plants, was immersed in boiling alcohol and analyzed after one day, six months, and seven months. "Determinations were made of ammonia, amide, amino, and nitrate nitrogen. No significant changes occurred in the ammonia. The amide nitrogen indicates a slight loss. The amino nitrogen shows a decided loss on storage. The nitrate nitrogen has shown no loss at the last analysis."

Studies on the utilization of soybeans.—"A crystalline substance removed from soybeans by acetone extraction following extraction of fat with petroleum ether was purified by recrystallization and identified as sucrose by means of a determination of its specific rotation and quantitative reduction after hydrolysis with invertase. Studies of the effect of different methods of extraction of soybean oil on the quality of the oil show that satisfactory nonbreak oils may be obtained by extraction with solvents or by cold pressing. The results indicate that the color in the 'break-test' is related to the temperature at which the beans are heated in the pressing of the oil."

Studies on glutelins.—VI, The optical rotation of the glutelins of wheat, rye, barley, maize, and rice, F. A. Csonka, M. J. Horn, and D. B. Jones (*Jour. Biol. Chem., 89 (1930), No. 1, pp. 267–273, fig. 1*).—The authors of this series (*E. S. R., 61, p. 801*) from the Protein and Nutrition Division, U. S. D. A. Bureau of Chemistry and Soils, report that "the α- and β-glutelins of wheat show different optical rotations. No difference was observed in the optical activity of the α- and β-glutelins of hard wheat, and that of the corresponding proteins of soft wheat. An equation of the type $y=ax^b+c$, proved to be applicable to the racemization curves of gliadin, and to the α- and β-glutelins of wheat."

Some observations on the action of alkali upon cystine and cysteine, H. T. Clarke and J. M. Inouye (*Jour. Biol. Chem., 89 (1930), No. 1, pp. 399–419, figs. 6*).—According to this contribution from Columbia University, "the formation of pyruvic acid as an intermediate product in the decomposition of cystine by alkaline plumbite has been confirmed by the isolation of its p-carboxyphenylhydrazone when the reaction is carried out in the presence of a salt of p-hydrazinobenzoic acid. Cysteine yields the same product under similar conditions. Pyruvic acid condenses in alkaline solution with salicylaldehyde, producing a characteristic orange color. This same color is gradually developed on bringing together cystine (or cysteine) and salicylaldehyde in alkaline solution, either alone or in the presence of plumbite. Certain other compounds of analogous structure, notably α, β-dibromopropionic acid and β-chlorolactic acid, respond qualitatively in the same way. Cysteine is capable of yielding all of its sulfur in the form of lead sulfide on being subjected to the action of alkaline

plumbite. Cystine, on the other hand, normally yields only 75 per cent, the remainder appearing largely as thiosulfate. Higher values are sometimes obtained, apparently through the reducing influence of decomposition products or of added substances.

"In the alkaline decomposition of cystine, ammonia is formed in amounts not more, and frequently less, than the corresponding quantities of sulfide. Recombination of ammonia with decomposition products appears to occur with the formation of substances which are relatively slowly broken up by alkali. The decomposition of cystine is accelerated by the addition of benzaldehyde, salicylaldehyde, and pyruvic acid. This effect is reflected in the S-shaped velocity curve representing the formation of lead sulfide from cystine and alkaline plumbite. Addition of sodium *p*-hydrazinobenzoate prevents the increase in velocity, presumably by combining with the pyruvic acid as it forms. Indications have been obtained that when cystine reacts with sodium hydroxide solution alone, an unstable product is primarily formed before sulfide ion makes its appearance."

Further biochemical studies on the antineuritic vitamin, A. Seidell and M. I. Smith (*Pub. Health Rpts.* [*U. S.*], *45* (*1930*), *No. 52*, *pp. 3194–3200*, *fig. 1*).—In the studies reported, the injection method of Smith previously noted (E. S. R., 63, p. 291) was used to control chemical fractionation steps applied to a vitamin salt mixture prepared from brewers' yeast by a process involving adsorption on fuller's earth and subsequent purification by benzoylation (E. S. R., 61, p. 710).

The vitamin-containing salt prepared in this way usually has a nitrogen content of about 1 per cent and protects pigeons from loss in weight on an exclusive diet of polished rice in alternate day doses containing from 0.15 to 0.3 mg. of nitrogen. In attempts to find a suitable solvent for separating the vitamin from sodium chloride, the principal inorganic constituent of the vitamin salt mixture, a mixture of 3 volumes of normal propyl alcohol and 1 of concentrated hydrochloric acid (d=1.19) used in the proportion of 3 cc. of the solvent per gram of the vitamin salt was found the most satisfactory. After the mixture has been agitated constantly for 18 hours, the solution on separation from the insoluble salts by centrifugation contains about 60 to 80 per cent of the nitrogen originally present and a corresponding proportion of the active substance. If the process is repeated an additional amount of the vitamin is recovered. The combined extracts are evaporated or distilled, yielding a semisolid residue which on digestion with a small amount of methyl alcohol leaves an inactive residue and the active material in solution. When the methyl alcohol solution as thus prepared is poured slowly, with active stirring, into 10 or more volumes of acetone a more or less voluminous white precipitate is formed, yielding, after centrifugation and vacuum drying, a white powder usually containing from 7 to 11 per cent of nitrogen. This material is usually active in pigeons in doses of about 1 mg. and cures polyneuritis in rats in doses of about 0.5 mg.

A platinum precipitate can be prepared from this product by redissolving it in not more than 10 cc. of methyl alcohol per gram of sample and adding a 10 per cent solution of platinic chloride in methyl or ethyl alcohol. The precipitate is separated by centrifugation, washed with methyl alcohol, suspended in methyl alcohol to which a few drops of hydrochloric acid have been added, treated with hydrogen sulfide for several hours, and allowed to stand overnight. After removal of the black platinum sulfide the methyl alcohol solution yields upon evaporation a residue which is extremely soluble in methyl alcohol, very slightly soluble in ethyl alcohol, and insoluble in acetone or ethyl ether.

Attempts to secure crystals from this by the process of Jansen and Donath (E. S. R., 57, p. 489) have been unsuccessful, but a slight increase in activity, accompanied, however, by considerable loss of active material, has been obtained by adding absolute ether very gradually to the methyl alcohol solution and placing the mixture in a desiccator containing calcium chloride as a drying agent and a beaker of ether to provide for a gradual increase in concentration of the ether in the methyl alcohol solution. A deposit is gradually formed, and this is dissolved in methyl alcohol and subjected to the same treatment. The best samples thus obtained were effective in curing polyneuritis in rats in doses of 0.05 mg. and protected rice-fed pigeons against loss of weight in doses of about 0.2 mg. The nitrogen content varied from 10 to 13 per cent.

Experiments in which this material was injected intravenously into rats on diets deficient in both the antineuritic and thermostable water-soluble vitamins and the antineuritic vitamin alone showed that the concentrate is a highly active antineuritic fraction probably wholly free from the thermostable factor.

A direct comparison of the activity of vitamin crystals furnished by Jansen and the most highly purified fraction of the present study showed that the two samples were of almost identical activity on the nitrogen basis.

Development of quantitative chemical methods for determination of cellulose (*Iowa Sta. Rpt. 1930, p. 62*).—In the case of the analysis of cotton and wool mixtures, treatment with normal sodium hydroxide under various temperature-treatment period conditions resulted in the solution of from 1.38 to 3.51 per cent of the cotton. Similar experiments on cotton and silk mixtures with a variety of reagents, temperature and time periods, showed solution of the cotton to an extent ranging from 0.24 to 1.67 per cent. In the case of cotton mixtures with cellulose acetate, 70 per cent acetic acid applied at room temperature for 90 minutes dissolved 0.21 per cent of the cellulose. Also, in the analysis of the two types of mixtures last named, "ammoniacal nickel hydroxide proved unsatisfactory as a solvent for the silk of a silk-cotton union. Ammoniacal nickel oxycarbonate was found unsatisfactory for dissolving silk." Acetone and aniline were unsatisfactory as solvents for cellulose acetate in the quantitative determination of cotton.

The chemical analysis of butter, E. S. GUTHRIE ET AL. (*Jour. Dairy Sci., 13 (1930), No. 5, pp. 380–393, figs. 6*).—This is a report by the subcommittee on chemical analysis of butter of the American Dairy Science Association, describing the operation of the Kohman method of analyzing butter and the equipment and supplies necessary for such analyses, and showing how results obtained by the method compare with results obtained by the procedure recommended by the Association of Official Agricultural Chemists.

Suggested methods for the microbiological analysis of butter, E. H. PARFITT ET AL. (*Jour. Dairy Sci., 13 (1930), No. 5, pp. 394–405*).—A tentative report submitted by the subcommittee on microbiological methods of examining butter of the American Dairy Science Association.

The swelling of canned prunes, E. M. MRAK and P. H. RICHERT (*California Sta. Bul. 508 (1931), pp. 24, figs. 8*).—Noting the limitation of the commercial production of tinned prunes (dried prunes tinned in sirup) by spoilage losses due to hydrogen swells, the bulletin reports experiments leading to the following among other findings:

"Swelling of enamel-lined cans was more rapid than of coke-plate cans; that of charcoal-plate cans was slower than that of coke-plate cans. The procedure used in drying prunes apparently had no effect on the rate of swelling. Canned sun-dried and dehydrated prunes swelled at the same rate. When the time or temperature of steam or water blanch was increased the rate of swelling

increased. The rate of swelling decreased when the concentration of sirup used was increased. However, 30 per cent sirup was found to be the maximum sugar concentration that could be used because more concentrated sirups caused the prunes to harden and shrivel. The rate of swelling decreased when the depth of head space was increased. A comparatively large head space should be used as this provides additional space for collection of the hydrogen gas. An exhaust in steam for 10 minutes at 210° F. was found best. The kind of gasket used had little effect on the rate of swelling; paper gaskets and rubber compound gaskets gave similar results. Cooking for 1 to 1.5 hours in boiling water was found best for canned prunes. Pressure cooking increased the rate of spoiling. Decreasing the pH value of the sirup retarded the rate of swelling but not of corrosion, and it affected the color of the prunes adversely. Factory tests confirmed all the major findings of laboratory experiments. Canned prunes should be distributed very soon after packing. If storage is necessary the storage temperature should be as low as practicable in order to retard corrosion."

METEOROLOGY

Forecasting the yield of wheat, M. Machali (*Prévision du Rendement du Blé d'après les Éléments Météorologiques. Paris: Marcel Rivière, 1931, pp. 92+[2], figs. 2*).—This is a study of the application of conventional statistical methods to the determination of the relation of the yield of wheat in France to the meteorological elements, especially rainfall, from time of seeding to harvesting.

The humming of aerial wires and atmospheric disturbances [trans. title], A. Nodon (*Compt. Rend. Acad. Sci.* [*Paris*], *191* (*1930*), *No. 20, pp. 959–961, fig. 1; abs. in* [*Internatl. Rev. Agr.*], *Mo. Bul. Agr. Sci. and Pract.* [*Rome*], *22* (*1931*), *No. 2, pp. 41, 42*).—As a result of several years' study of the subject, the author concludes that the humming of overhead wires has an important relation to atmospheric conditions and changes. He states that "the vibration preceded atmospheric change by about 20 hours. The direction of the following atmospheric disturbance would be perpendicular to that of the vibrating wire. . . . The intensity and duration of the probable disturbances are related to the intensity and persistence of the vibration of the wire." He suggests that "the systematic study of the humming of aerial wires by means of an amplifier would provide useful data for weather forecasting."

Dew and aqueous deposits from the air [trans. title], L. Chaptal (*Ann. Sci. Agron. Franç. et Étrang., 47* (*1930*), *No. 1, pp. 69–77, pls. 2; abs. in Internatl. Rev. Agr., Mo. Bul. Agr. Sci. and Pract.* [*Rome*], *21* (*1930*), *No. 10, pp. 361, 362*).—Experiments are reported which confirm previous conclusions that adsorption of aqueous vapor from the air by the soil as distinguished from dew deposition is a general and important phenomenon in hot seasons in southern France. The apparatus and method used for distinguishing between the two sources of moisture are described.

Meteorological tables, D. A. Seeley (*Mich. State Bd. Agr. Ann. Rpt. Sec., 68* (*1929*), *pp. 71–83*).—Daily and monthly summaries of temperature, precipitation, cloudiness, and sunshine, and monthly summaries of pressure, wind movement, and miscellaneous phenomena (frost, hail, thunderstorms, fog, auroras, and halos), at Lansing, Mich., are given for the year ended June 30, 1929. Mean temperature and total precipitation for each month since 1863 are also given.

Meteorological report for 1929, F. E. Hepner (*Wyoming Sta. Rpt. 1930, pp. 47–50*).—The usual summaries are given of observations on pressure, tem-

perature, precipitation, wind, and sunshine at the University of Wyoming, Laramie. The mean pressure for the year was 22.84 in. The mean monthly temperature was 39.6° F., the highest 86° July 26, the lowest −21° November 20. The last killing frost in spring occurred June 3, the first in autumn September 6. The total annual precipitation was 15.07 in. The number of clear days was 149. "The lowest barometer reading ever observed at this station, 22.129 in., occurred at 3 p. m., January 17; the coldest monthly mean temperature on record for a November occurred this year; and the total precipitation for the year, 15.07 in., is slightly in excess of any year previously recorded."

SOILS—FERTILIZERS

[Soil and fertilizer investigations, Indiana Station] (*Indiana Sta. Rpt. 1930, pp. 17, 18, 70–73, 81, 85–88, figs. 3*).—The soil and fertilizer experiments reported include the following:

Availability and efficiency of phosphates.—Greenhouse experiments covering nine years "have shown that superphosphate and other soluble forms of phosphoric acid are equally available to crops whether they are applied to the soil directly or have been previously mixed with and fixed by calcium, magnesium, or aluminum compounds. When fixed by iron the phosphate is not quite as efficient. Soluble phosphates fixed by lime in the laboratory have been superior to raw rock phosphate. . . . Grinding the raw phosphate extremely fine has increased its efficiency only slightly." When soluble phosphates were applied to the soil the phosphorus was found to be immediately so fixed that it would not leach out. "In the field experiments at Bedford on a light colored silt loam, one-half ton of superphosphate per acre applied once each nine years has been as efficient as an equivalent quanity of superphosphate distributed one-third each three years."

Potash in relation to growth and development of plants.—Of the three experiments here noted two relate to corn results on soils supplied with potassic fertilizers at three rates. In the first experiment noted "the high amount of potassium produced plants of high sugar content." In the second, in which the rates of application of the potassium are specified as supplying 0, 36, and 126 lbs. to the acre, respectively, of potassium oxide, "the plants grown on plats which were treated with 126 lbs. of potash per acre had a much higher sugar content than those from the other plats."

Studies of laboratory methods of determining the fertilizer needs of soils for crop plants, with special emphasis on the Neubauer method.—Specifying certain experimental conditions considered of special importance, the report notes that "generally, the results of the Neubauer method are in closest agreement with the results of pot tests and with the results of field tests when proper consideration is given to other possible limiting factors. . . . For the Neubauer method tentative limit values for deficiencies as applied to average crops under Indiana farming conditions are placed at 4 mg. phosphoric anhydride for phosphorus and 10 mg. potassium oxide for potassium."

[*Fertilizer treatment, Moses Fell Annex Farm*].—"Untreated soil has averaged approximately 21 bu. of corn, 4 bu. of wheat, and a half ton of hay. Land receiving lime, manure, and 450 lbs. of 16 per cent superphosphate has averaged approximately 53 bu. of corn, 15 bu. of wheat, and a ton and a half of hay. An expenditure of $5.04 per acre per rotation for superphosphate has given a return of $36.85 per acre per rotation."

[*Muck soil experiment, Pinney-Purdue Farm*].—The soil with which this experiment is concerned is a deep nonacid muck. "The results to date show

that potash is an important and very profitable fertilizer element for all the crops in the test."

[*Fertilizer trials, Davis Forestry Farm*].—It is noted that "400 lbs. of 2-12-6 fertilizer have shown a net gain due to fertilizer amounting to $19.42 per acre per rotation."

[*Fertilizer trials, Purdue-Vincennes Farm*].—Fertilizer treatment was found more profitable on limed than on unlimed land. "The phosphate-potash mixture has been more profitable than either phosphate alone or complete fertilizer. Nitrogen has shown good returns on the wheat. It has not produced profitable increases on corn. Manure has produced excellent returns, averaging $2.97 per ton of manure applied." Details of the fertilizer-rotation trial are presented.

[**Soil and fertilizer investigations, Iowa Station**] (*Iowa Sta. Rpt. 1930, pp. 15, 16, 43-47, 51, 52*).—This report includes the following items:

Fertilizers for peat soils in Iowa.—Peat areas, well drained and either pastured or kept in vegetable crops for two or three years, were successfully cropped to corn and small grains with the use of superphosphate and potassium chloride at 200 lbs. to the acre.

Sodium nitrate fertilization studies.—Sodium nitrate as an early application fertilizer for oats was tested in field experiments on Shelby loam and Carrington loam, and was found to increase the yield appreciably, early being more effective than late applications. The protein content of the grain was increased both with the early and late applications, the latter having a somewhat greater effect. Late applications as a top-dressing for wheat were slightly more effective than early additions. There was no large effect from the treatments on the protein content of the grain. "On 16 fields in various parts of the State on nine minor soil types, nitrate was applied at the rate of 100 lbs. per acre to corn in early, divided, and late applications. . . . The divided application gave somewhat greater effects than the early or late applications."

Studies on Rhizobium leguminosarum.—"Tests of the ability of certain strains of *R. meliloti* and *R. japonicum* to fix nitrogen in the absence of the host plant have been made in both nitrogen-free media and media containing combined nitrogen. The results show that the amounts of nitrogen fixed were too small to be significant.

"Studies have been made of the changes produced by *R. meliloti* and *R. japonicum* in nitrogenous compounds in solution cultures in order to obtain a more definite insight into the nitrogen metabolism of these organisms. . . . The results indicate that the changes produced in certain of the compounds may prove of value in the differentiation of species, while certain other changes may be useful in separating types within the species."

Humus investigations.—In addition to work previously noted (E. S. R., 63, p. 216), experiments on carbon dioxide production and soil respiration are briefly noted which seemed to show "a definite increased acidity as measured by the respiration due to cropping system and soil treatment." As regards the nitrogen content of sweetclover at different stages of growth, it is noted that, from May to September, "the nitrogen content decreased slowly in both roots and tops until September, when it was decreased markedly. The nitrogen content of roots and tops was higher in the fertilized clover than in the unfertilized."

Studies on artificial manures.—Further studies (E. S. R., 64, pp. 120, 322) on the production of artificial manure under farm conditions indicate that "a mixture of equal parts of cyanamid and rock phosphate may be as effective as the Adco reagent, and the cost of production is materially reduced. . . . The average rainfall in the vicinity of Ames is not sufficient for thorough decompo-

sition of the straw. The addition of approximately 400 gal. of water per ton of straw was sufficient to supplement the rainfall and produce a fair grade of strawy manure from threshing time until the next March. Studies under way indicate that a better grade of manure can be made in this way if the manure is allowed to decompose through the second summer and will be ready for application as a top-dressing in the fall."

Chemical and bacteriological effects of liming and legume inoculation on soil conditions in the southern Iowa loess soil area and on the yield, composition, and value of the legumes grown.—"Greater bacterial action in the soil occurred after the hydrogen-ion concentration had been reduced. There was a direct correlation between the nitrifying power of the soil and the pH. The nitrifying power of the soils was increased as the pH of the soil was increased. . . . The largest increases in yield and the most improvement in quality brought about by inoculation occurred on the soils which had received enough limestone to neutralize the acidity." This experiment emphasizes the need of lime and inoculation for the best growth of soybeans on certain acid soils.

The degree of saturation and the amount of exchangeable bases in these soils were increased more by the finer grades of limestone and hydrated lime than by the coarser grades of limestone. Practically no difference was noted between high calcium and high magnesium limestones and various combinations of calcium and magnesium carbonates. The purity and fineness of division of the materials seemed to be more important than the content of calcium or magnesium.

[Soil and fertilizer work of the North Carolina Station], C. B. WILLIAMS (*North Carolina Sta. Rpt. 1930, pp. 41–51, 52, 53, 55, 56, 57–60, 61, 63, 64, figs. 10*).—A large number of items are included.

Magnesia deficiencies of representative sandy soil types of the Coastal Plain.—"There is at present no distinct evidence in the analysis of drainage waters of a depression in the solubility of soil magnesium consequent to the addition of calcite limestone, but the growth and magnesia content of soybeans grown on soils treated identically as were those in the lysimeters shows a decided depression in magnesia content as a consequence of heavy liming with calcite. The effects of chloride and sulfate of potash on the solubility of native and added magnesia show no certain differences referable to the two sources of potash," but soybean plants showed some effects of the added potash salts. "Most important of these is the decided superiority of the sulfate, which is assumed to indicate a serious sulfur deficiency in these soils. . . . With this unforeseen deficiency as a factor, the results indicating differences in the magnesia content of the soybeans grown with the two sources of potash are not to be interpreted at this time with any great degree of confidence. . . . However, . . . plants grown with sulfate of potash contain greater amounts of magnesia than those with the chloride except where magnesia is added in dolomite, in which cases the relationship is reversed."

A study of plant responses to some ammonia: calcium ratios in fertilizers.—Injury to cotton seedlings by concentrated fertilizers showed itself due to "free ammonia resulting from the dissociation of diammonium phosphate used as a source of phosphoric acid. This injury could be controlled by admixtures of calcium salts. Magnesium salts were less effective." Gypsum applications decreased the ratio "free" to "fixed" ammonia, according to the figures given.

Factors influencing the productivity of muck soils.—"The work with copper and manganese shows a distinct response to applications of six tons of lime broadcast and copper sulfate at 50 lbs. per acre in the drill." The need for manganese applications was not definitely demonstrated. "In the unlimed

soil, copper appears to be slightly toxic, with 2 tons of lime it is without effect, while with the 6-ton rate of liming copper is decidedly beneficial, although with lime alone the yield at the 6-ton rate was inferior to that with 2 tons. . . . A preliminary test of the effect of the gypsum content of the superphosphate has been started, using monoammonium phosphate as a source of phosphoric acid. Symptoms typical of superphosphate injury have appeared on the plat with the gypsum treatment, while the plants grown on the gypsum-free fertilizer are normal."

[*Fertilizer tests of the Coastal Plain Branch Station.*]—Under the two heads of soil fertility experiment (Norfolk fine sandy loam) and soil type experiment (Dunbar fine sandy loam) fertility tests, for the most part of the usual type, are discussed in some detail. In the soil type experiment a typical manganese deficiency (E. S. R., 54, p. 450) appeared in soybean plants. This chlorosis was "closely associated with heavy applications of lime."

[*Experiments on Norfolk sandy loam, Upper Coastal Plain Branch Station.*]—Providing part of the nitrogen for cotton from nitrate of soda and part from sulfate of ammonia was somewhat more beneficial than either source singly. When limed were compared with unlimed rotations, the best results appeared in a 3-year rotation with complete fertilizer treatment (E. S. R., 59, p. 326). Other rotation and fertilizer treatment results are tabulated, much as in the preceding year (E. S. R., 63, p. 614).

[*General fertilizer experiment (muck soil), Blackland Branch Station.*]—Rotation and fertilizer tests of the usual type are reported and discussed. Though less severe on plats given potassic fertilizer, "corn grown on the plats not receiving potash was infected practically 100 per cent with root rot."

Lime experiment.—The effectiveness of ground limestone, hydrated lime, and marl decreased in the order in which the materials are mentioned. An 8–2–4 fertilizer increased yields when used with ground limestone, but "when used without lime the yields have been decreased."

[*Fertilizer and rotation tests of the Mountain Branch Station*].—Under various subheads are stated the fertilizer formula and application rate found best suited in each case to a specific combination of crop, rotation, and local soil type. On Toxaway loam soybeans grown for hay gave better results with rock phosphate than with superphosphate when the rock phosphate application carried twice the phosphoric acid content of the superphosphate treatment. Corn did better on superposphate treated soil.

[*Fertilizer and lime tests of the Piedmont Branch Station*].—The tests were for the most part rotation and fertilizer trials of the usual form. A comparison of superphosphate with rock phosphate indicated that for red clover, and when these were applied in quantities equivalent in phosphoric acid content, the rock phosphate was not equal to the superphosphate in effectiveness. Nitrogenous fertilizers ranked as follows on the 2-year alternation of corn and cotton: Nitrate of ammonia, sludge, urea, cottonseed meal, nitrate of soda, calcium cyanamide, Leunasalpeter, and sulfate of ammonia.

[*Fertilizer and lime trials of the Central Station*].—"In a comparative study of the value of burnt lime, hydrated lime, and ground limestone applied every fourth year at rates equivalent to 1, 2, and 4 tons of calcium carbonate per acre, . . . yields with soybeans for seed in 1929 were highest from an unlimed check plat. The second highest yield was obtained from the use of 2 tons of burnt lime per acre. Yields from 1 ton of ground limestone ranked third. The 1-ton rate per acre proved most efficient for hydrated lime and ground limestone, while the two-ton rate was most efficient for burnt lime. The 4-ton rate of application gave the lowest yields in all cases. The soybeans showed much evidence of potash deficiency, especially on the heavily limed plats."

Fertilizer results from outlying soil-type fields with farmers of the State.—Findings primarily of local significance are given. On Ashe loam phosphate was apparently the most important need for corn. On Toxaway loam "results with corn for 1929 have shown a beneficial effect from the use of lime on this soil, having a pH value of around 5.2. Increasing the percentage of phosphoric acid in a complete fertilizer had most effect in increasing yields, nitrogen ranking next in importance."

As sources, respectively, of potassium, nitrogen, and phosphorus, kainit, calurea, and superphosphate showed themselves most satisfactory. Increased cotton yields indicated total fertilizer needs up to 900 lbs. to the acre. On Wilkes sandy loam "the chief deduction to be drawn from the 1929 results is the value of high potash fertilization" in the case of Japanese mint.

[Soil Survey Reports, 1926 Series] (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpts.], Ser. 1926, Nos. 28, pp. 35, fig. 1, map 1; 29, pp. 40, fig. 1, map 1; 32, pp. 55, pls. 2, figs. 2, maps 2*).—These surveys were carried out with the respective cooperation of the Department of Conservation and Development of New Jersey and the New Jersey Experiment Stations, the Michigan Experiment Station, and the Arizona Experiment Station.

No. 28. *Soil survey of the Camden area, New Jersey*, R. T. A. Burke and L. L. Lee.—The Camden area occupies nearly all of Camden County, about two-thirds of Gloucester County, about one-sixth of Burlington County, and small parts of Atlantic, Salem, and Cumberland Counties, and lies in the west-central part of southern New Jersey. The tract surveyed occupies 449,280 acres, and comprises level or gently rolling country ranging in elevation from tide level to 214 ft. above, of which the drainage is effected by numerous small streams.

A total of 28 types of 13 series, with 5 per cent of unclassified city land and 9.9 per cent of tidal marsh and swamp, reclaimed tidal marsh, and meadow, are mapped and described. The most extensive type found was Sassafras sandy loam, of which 16.6 per cent was noted.

No. 29. *Soil survey of Tuscola County, Michigan*, E. B. Deeter and A. E. Matthews.—Tuscola County, southeastern Michigan, includes a land area of 519,680 acres. The county lies entirely within the glaciated region and possesses a considerable range of variation in topographic features. The area drains to Saginaw Bay through the Cass River, directly through ditches, and through tributaries of the Cass River.

The soils of Tuscola County consist of Brookston loam, occupying 20.1 per cent of the land area of the county, Miami loam with 15.1 per cent, and others to constitute a total of 34 series inclusive of 38 types.

No. 32. *Soil survey of the Salt River Valley area, Arizona*, W. G. Harper et al.—The Salt River Valley area consists of 342,400 acres in south-central Arizona, of which the surface features for the most part take the form of a strip of nearly level alluvial stream bottom land and low isolated mountain masses of small extent from which are spread out a series of alluvial fans and fan slopes. "The regional drainage of the area as a whole is very good."

The soils of this area were found to constitute 8 series of 37 types. Mohave sandy loam and Mohave loam are the most extensive types listed, occupying 8.9 and 7.6 per cent, respectively, of the total area.

[Soil Survey Reports, 1927 Series] (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpts.], Ser. 1927, Nos. 9, pp. 33, fig. 1; map 1; 10, pp. 26, fig. 1, map 1*).—The two surveys here noted were made with the cooperation of the West Virginia Geological Survey and the University of Nebraska, respectively.

No. 9. *Soil survey of Hampshire County, West Virginia*, B. H. Williams.—Hampshire County, in northeastern West Virginia, covers an area of 409,600 acres, ranging, with respect to relief, from the mountainous section contributing the greater part of the 10.2 per cent of rough stony land found to rolling and gently rolling valley lands. All drainage waters of the county eventually reach the Potomac River.

The more extensive soil types were found to be 15.9 per cent of Dekalb shaly silt loam, 15 per cent each of Dekalb gravelly silt loam and Dekalb stony fine sandy loam, and 11.2 per cent of Meigs gravelly fine sandy loam. Other classified types bring the total to 24 types, 12 series.

No. 10. *Soil survey of Hamilton County, Nebraska*, A. W. Goke and W. H. Buckhannan.—Hamilton County, in southeastern Nebraska, contains 344,320 acres in general level to undulating. The drainage is provided in part by the Platte River and its tributaries. Hastings silt loam, listed as covering 56.1 per cent of the county area, together with 12.8 per cent of a slope phase of the same type, separately listed, is the predominant soil type noted.

[Illinois soil reports] (*Illinois Sta. Soil Rpts. 47 (1930), pp. 55, pls. 2, figs. 13; 48 (1931), pp. 55, pls. 2, figs. 16*).—The two reports here noted classify the soils found, as in previous reports (E. S. R., 63, p. 618). Each report contains also the usual sections on the chemical composition of the soils of the county surveyed and on field experiments upon soil types similar to those of the county surveyed, together with an appendix on the principles of soil management.

No. 47. *Piatt County soils*, R. S. Smith, E. E. DeTurk, F. C. Bauer, and L. H. Smith.—Piatt County occupies an area of 276,941 acres near the center of the State, and has a gently rolling to nearly level surface. "No soil is known to occur in Piatt County which will not underdrain satisfactorily."

A brown silt loam, covering 45.27 per cent of the total area of the county, and a black clay loam on drab clay, which occupies 37.87 per cent, are the soils of notable extent among 19 color-texture types here mapped and described.

No. 48. *Effingham County soils*, E. A. Norton, R. S. Smith, E. E. DeTurk, F. C. Bauer, and L. H. Smith.—Effingham County, south-central Illinois, includes 300,384 acres, mostly level uplands.

The soils of Effingham County are here mapped and described as 11 color-texture types, of which 45.84 per cent of a gray silt loam on tight clay, and a yellow-gray silt loam on compact medium-plastic clay amounting to 19.13 per cent of the soil area of the county, are the more extensive.

Soil survey of the Deming area, New Mexico, A. T. Sweet and E. N. Poulson (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpt.], Ser. 1928, No. 2, pp. 20, pls. 2, figs. 2, map 1*).—The Deming area consists of 176,640 acres in Luna County, southwest New Mexico, and is in general a broad desert plain, requiring irrigation. The soils of the Deming area were found to consist of 3 series inclusive of 12 types, Mimbres silty clay loam occupying 20.5 per cent, Mimbres fine sandy loam 15.5 per cent, and Karro loam 13.1 per cent.

Muck soil investigations: Progress report, Sanpete County Experimental Farm, 1927–30, inclusive, L. Wilson and G. Stewart (*Utah Sta. Bul. 224 (1931), pp. 24, figs. 8*).—The nature of the soil area, dealt with from the immediately practical viewpoint and the cultivational practices necessary for its successful use, are here considered in a preliminary report. The subjects taken up include sod-breaking and pulverizing, soil moisture, alkali (the soil was found to be of a saline, rather than of an actually alkaline type, its principal undesirable components being sodium sulfate and sodium chloride), ground water, rolling (this practice increased the yields of barley, oats, and

peas), plowing and seed bed preparation, fertilizers (the combinations successful with barley are given as manure, superphosphate, potash and superphosphate, and manure and superphosphate), frost, and crop adaptability.

["Alkali" soil investigations of the Wyoming Station] (*Wyoming Sta. Rpt. 1930, pp. 10–12, 37*).—Laboratory tests indicated beneficial effects from sulfur, gypsum, and ammonium alum treatments; but "the treatment with gypsum at the rate of 5 to 10 tons per acre seemed to be the only one that could be applied at a cost that would not be prohibitive."

On the Lyman State Farm, "one plat in which irrigation water is ponded and allowed to remain on the land through July and August of the previous year gave the largest yield of any of the plats. . . . Flushing the soil by irrigation water throughout the entire year reduced the alkali content from 0.75 per cent to 0.01 per cent in 12 months. At a depth of 24 in. the content had been reduced from 0.46 per cent to 0.06 per cent. This work gives promise of solving the question of utilizing lands impregnated with alkaline salts."

The preservation of manure under arid climatic conditions, H. N. Watenpaugh (*New Mexico Sta. Bul. 190 (1931), pp. 8, figs. 3*).—Storage tests with a carload of horse manure from Fort Bliss over a period of 110 days beginning December 9 are reported. The manure was stored (1) in a loose pile, (2) tramped in a compact pile, (3) tramped in a compact pile and kept wet, (4) tramped in a dirt pit, (5) tramped in a dirt pit and kept wet, and (6) spread in a thin layer on the ground.

"From the data of this experiment it seems that the best preservation of manure is dependent on two main factors: (a) That the wet manure should be compacted upon storage, and (b) as little surface should be exposed to climatic conditions as possible. When the manure is to be applied several weeks before planting, yields of seed cotton seem to be dependent on two factors: (a) The amount of disintegration without much loss of organic matter, and (b) the amount of nitrogen conserved. . . . When horse manure containing approximately 50 per cent water is stored over a period of about three months, the above conditions seem to be most closely and economically met where it is compacted by trampling in a dirt pit." The results of the experiment showed that by this method, however, the yields were not as large as that from a material which was more decomposed. "However, . . . when the manure is applied to the soil, disked in, and irrigated at least two or three months before planting, it will have ample time to decompose without the loss of the nitrogen and the beneficial effect of the decomposing manure, and will subsequently produce a more lasting effect."

Suitable fertilizer mixtures for different crops, including the function of chief plant nutrients, C. B. Williams and H. B. Mann (*North Carolina Sta. Agron. Inform. Circ. 60 (1931), pp. [1]+11*).—The indicated information is given in popular form and is of local application. The needs of the various agricultural divisions of the State are separately treated.

AGRICULTURAL BOTANY

Plant physiology [at the North Carolina Station] (*North Carolina Sta. Rpt. 1930, p. 110*).—Studies by D. B. Anderson of the influence of calcium sulfate dusts on the transpiration rates of peanuts and other plants indicated that such dusting had little effect on the rate of water loss. In studies of the upper cell wall of peanut plants, abundant crystals of calcium oxalate were found. Stomata were about equally abundant on the upper and lower surfaces. In view of the abundant crystals of calcium oxalate in the cell wall, it is deemed likely that calcium sulfate dust does not stimulate the plant through

the absorption of the calcium ion by leaf tissues. Layers of cutin, pectic compounds, and cellulose were found in the outer epidermal walls. An examination of the cell wall structure of various plants in the sand hill region showed no correlation between the habitat and epidermal cell wall structure.

The nature and functions of plastids, especially elaioplasts, R. A. Harper (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 1, pp. 311–316*).—The author details, comparatively, selected views, with some which have emerged from his own work.

Criticizing the idea that such bodies as elaioplasts are somehow agents rather than loci for specific reactions in the cells, which conception is embodied in the doctrine of individuality of cell organs, the author favors the assumption that whatever a given organ does or seems to do can only be regarded as an expression of the metabolism of that organ or of adjacent organs acting upon it, and that it is an agent only in the sense that it is a locus for a specific activity.

Action of the parasite upon the chondriome-plastidome [trans. title], J. Beauverie (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1299–1311, figs. 6*).—In this account are considered in detail principally variations of resistance in mitochondria and plasts of plant cells to osmotic action, and their fragilization under parasitic action.

The osmotic quantities of the plant cell, A. Ursprung (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1081–1094, figs. 4*).—For a general impression of the osmotic quantities of a cell, the results are given in tabular form with description, as obtained from studies of a cell from the stem pith of *Impatiens noli tangere*.

Cell- and seed-stimulation [trans. title], M. Popoff (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1180–1182*).—A review is given of the developments regarding cell- and seed-stimulation during the period 1914–1926.

Storage of carbohydrates in seeds (*Iowa Sta. Rpt. 1930, p. 27*).—Among the carbohydrates found in seeds were free sugars, dextrins, starch, and the more insoluble forms, such as pentosans and hexosans. The last two represent a form of storage material and are also used as a source of food during germination. Oats, garden peas, soybeans, peach kernels, peach stone shells, and date seeds contained 11.5, 10, 7, 3.5, 18, and 31 per cent, respectively, of these pentosans and hexosans. After germination for 44 days the young date seedlings used over 80 per cent of these reserve carbohydrates.

Physiological investigations on orchid seed germination, L. Knudson (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1183–1189, fig. 1*).—"In conclusion it is my opinion that the unusual requirements of orchid embryos for germination may be explained on the inability of these plants to synthesize food. They are therefore purely saprophytic in early life and must obtain organic food from the substratum. The fungus is a pathogen held in check, or not, depending on the physiological condition of the host. The constancy of association of fungus and orchid merely signifies to me that the orchid fungi are as widely distributed as the orchid plants. There is no reason for assuming a significant relationship other than mild parasitism."

Manganese as an essential element for plant growth, G. Samuel and C. S. Piper (*Ann. Appl. Biol., 16 (1929), No. 4, pp. 493–524, pls. 3, figs. 2*).—The authors, having been able to confirm the conclusions of other investigators indicating that manganese is an essential element for plant growth, state, with particulars, that manganese becomes indispensable at an early seedling stage and remains so until a late growth period.

The influence of radioactivity on the plant organism [trans. title], J. [illegible]

1150).—Alluding without specific reference to researches which have been carried on, and their results obtained since 1906 regarding radioactivity as influencing physiologically the total energy and metabolic processes in plants, the author states that it is increasingly evident that radioactivity is a fundamental phenomenon, the knowledge gained from study of which is destined eventually to disclose profound secrets of life.

Effect of length of day on growth and development of plants, W. W. Garner (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1050–1055*).—In articles previously noted (E. S. R., 47, p. 225; 51, p. 125), the author with others has presented evidence tending to show that the relative length of day and night is important factorially in the growth and development of many plants. The simple method of experimentation followed is briefly described. Some features of periodism are here set forth, as are also some conditions favorable to increase in stature and in tuberization, with a discussion of the ecological significance, as yet not precisely ascertained, of the length of day. "It has been found experimentally, however, that when subjected to the combination of a long day and a cool temperature such as would be found in very high latitudes, the beet may become an annual."

The physiological nature of drought-resistance of plants, N. A. Maximow (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1169–1175*).—The author raises and discusses the question as to what are the peculiarities which allow xerophytic plants to inhabit dry and hot regions where mesophytic plants of the moderate humid climate perish from water deficiency.

The problem of excretion with especial reference to the contractile vacuole, F. E. Lloyd (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1163–1168*).—Citing related literature, the author states that contractile vacuoles, commonly regarded formerly as occurring only in the protista and in the motile forms of plants (fungi and algae), in which they have been variously considered as more or less specialized organs or organoids, have been shown to occur also in the conjugating gametes and in the condensing zygote of Spirogyra, probably also of other Conjugatae, and that they may also be induced in vegetative cells by the use of strong plasmolyzers, thus ranging much more widely than hitherto supposed.

The chief purpose of the present paper is to draw attention to a hitherto unrecognized example of water excretion by contractile vacuoles, namely, in Spirogyra gametes and zygotes. "It is, however, not possible to suppose that the water discharged is not accompanied by other substances in solution or in more or less solid condition. Indeed in many forms, solids or semisolids are dominant. *It is suggested that the contractile vacuole may be found to be* a widely distributed mechanism. Already there is tangible evidence in support of this idea."

On the origin of the thermal flora, T. V. Vouk (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1176–1179*).—The author offers reasons for holding that the property of thermophily in the Cyanophyceae is secondary in its nature, that is to say, "that the entire present thermal vegetation is only an adaptation flora to water of high temperature."

GENETICS

Chromosome numbers in cultivated cucurbits, T. W. Whitaker (*Amer. Jour. Bot., 17 (1930), No. 10, pp. 1033–1040, pl. 1*).—Studies at the University of Virginia showed 7, 11, 12, 11, 11, 20, 20, and 24 pairs of chromosomes in *Cucumis sativus*, *C. anguria*, *C. melo*, *Citrullus vulgaris*, *Lagenaria vulgaris*, *Cucurbita pepo*, *C. maxima*, and *C. moschata*, respectively. Certain of the more outstanding changes occurring during meiosis are described.

Chromosomal aberrants and gene mutations in Nicotiana obtained by grafting, D. KOSTOFF (*Jour. Genetics, 22 (1930), No. 3, pp. 399–418, figs. 28*).—Irregular meioses were observed in the pollen mother cells of the scions in the intergeneric graft unions *N. tabacum* on *Datura wrightii*, *N. langsdorffii* on *Solanum nigrum*, and *Petunia violacea* on *S. nigrum*. Such scions produced a high percentage of abortive pollen grains and pollen grains with increased numbers of chromosomes. The chromosomal aberrants (monosomic, trisomic, triploid, and hypertriplont) and gene mutations were found in the generations following the selfing of the flowers of the scions having abortive pollen grains. The controls, however, gave only normal plants.

The cytological identification of the chromosome associated with the R–G linkage group in Zea mays, B. MCCLINTOCK and H. E. HILL (*Genetics, 16 (1931), No. 2, pp. 175–190, figs. 4*).—A $2n+1$ plant of corn resulting from the cross diploid × triploid and its $2n+1$ progenies were found at Cornell University to give trisomic inheritance for *r*. In these plants the smallest chromosome was present in triplicate. In $2n+1$ individuals one-third of the eggs carry the extra chromosome, but in a normal pollination the extra chromosome-carrying pollen grains function only in a normal percentage of the cases. Plants trisomic for the *r–g* linkage group have given disomic inheritance for *c*, *wx*, *su*, *b*, *y*, gl_1, *pr*, *d*, and *a*.

The linkage groups *C–sh–wx*, *Y–Pl*, and $A–d_1–cr$ were found later to be associated with chromosomes other than the *r–g* carrying chromosome. Use of the method of association of linkage groups with particular chromosomes definitely established the independence of six of the ten linkage groups (*C–sh–wx*, *R–g*, *B–lg*, *Y–Pl*, *P–br*, and $A–d_1–cr$).

The genetics of cotton.—Part I, The inheritance of petal spot in New World cottons. Part II, The inheritance of pollen colour in New World cottons. Part III, The inheritance of corolla colour in New World cottons, S. C. HARLAND (*Jour. Genetics, 20 (1929), No. 3, pp. 365–385, pl. 1, fig. 1; 387–399, pl. 1; 21 (1929), No. 1, pp. 95–111, pl. 1; also Mem. Cotton Research Sta., Trinidad, Ser. A, Genet., No. 1 (1929), pp. 365–385, pl. 1, fig. 1; 387–399, pl. 1; 95–111, pl. 1*).—The genetic behavior of various types of petal spot, of pollen color, and of corolla color found in several types of New World cottons is described from extensive studies at the Cotton Research Station in Trinidad.

Experiments on the genetics of wild populations.—II, Phleum pratense L. and the hybrid P. pratense L. × P. alpinum L., J. W. GREGOR and F. W. SANSOME (*Jour. Genetics, 22 (1930), No. 3, pp. 373–387, pls. 3, fig. 1*).—The second of this series (E. S. R., 56, p. 728) dealt with some of the genetic and cytological relations of timothy.

Of two apparently intersterile groups of *P. pratense*, Group I appeared to be essentially a hay type while Group II occurs chiefly in waste places and natural pastures, although both may sometimes be present in the same habitat. Cytological examination showed that Group I is probably hexaploid with 42 as the somatic chromosome number, while Group II is diploid (14). Corresponding hereditary growth forms were observed within each group, and these also seemed to have ecological significance. Crosses between Group I (6*n*) and Group II (2*n*) and *P. alpinum* were attempted with varying degrees of success. A hexaploid form was obtained from *P. pratense* (2*n*)×*P. alpinum* (4*n*).

Inheritance in Lolium perenne L.—III, Base-colour factors C and R, T. J. JENKIN (*Jour. Genetics, 22 (1930), No. 3, pp. 389–394*).—The third study of this series (E. S. R., 60, p. 217), which deals with the genetic behavior of progeny of two plants of *L. perenne* found heterozygous for color of the lower part (base) of the living sheath, made it evident that the complementary

dominant factors *C* and *R* are concerned with the production of red base color. In the absence of either no red base color is developed.

The genetics of Habrobracon, C. H. Bostian (*North Carolina Sta. Rpt. 1930, pp. 156, 157*).—In genetic experiments with the parasitic wasp (*H. juglandis*) it was found that biparental males were produced only in crosses involving related stocks. Over 80 per cent of such males were sterile, and the offspring produced by the few fertile biparental males were very abnormal and completely sterile. The proportion of biparental males to all the offspring varied from 0 to 15 per cent. Higher temperatures seemed more conducive to their production than lower temperatures, and some progress was made in increasing the proportion of this type of male by selection. Biparental males are probably diploid in chromosome number.

The inheritance of morphological characters in cattle [trans. title], E. Lauprecht (*Züchtungskunde, 5 (1930), No. 6, pp. 241–261, figs. 10*).—This is a review of present information on the inheritance of color, conformation, and various other characteristics in cattle.

The production of hen-feathered Brown Leghorns by breeding, M. A. Jull and J. P. Quinn (*Jour. Heredity, 21 (1930), No. 4, pp. 176–186, figs. 6*).—By selection it was found possible to improve materially the type of hens produced in a hen-feathered flock of Brown Leghorns in a study of the Bureau of Animal Industry, U. S. D. A. In breeding studies it appeared that although hen-feathering is probably due to a single dominant factor, there are evidently one or more modifying factors which play a considerable rôle in determining the characteristic.

Studies on the physiology of the accessory glands of reproduction of the male guinea-pig, J. W. Lawlah (*Anat. Rec., 45 (1930), No. 2, pp. 163–175, pls. 2*).—In these studies removal or ligation of the seminal vesicles of male guinea pigs, while not preventing copulation, interfered with the sexual behavior of the males and made them incapable of forming a vaginal plug and fertilizing the females. Neither the removal of the prostate nor of Cowper's glands had any effect on copulation or fertilization. Removal of the prostate or ligation of the vas deferens had no influence on the macroscopic appearance of the testis and other accessory glands after 10 weeks. On the other hand, castration and spermatic-cord ligation produced gross degeneration of the accessory glands of reproduction.

The corpora lutea of the mouse, with special reference to fat accumulation during the oestrous cycle, R. Deanesley (*Roy. Soc. [London], Proc., Ser. B, 106 (1930), No. B 747, pp. 578–595, pls. 3, fig. 1*).—From a histological study of the ovaries of 11 unmated, 10 pseudopregnant, 17 pregnant, and 12 post-partum mice, changes in the structure of the corpora lutea associated with ovulation, pseudopregnancy, pregnancy, and lactation, and the sequence of fat changes in these bodies are described. As a result of the study it is concluded that "(1) fat may be comparatively light in the lutein cells at the time when the corpus luteum ceases to be the controlling factor, as at 18 days pregnant, and (2) the fat content may be heavy some days before any signs of the next oestrus appear, as in pseudopregnancy and lactation." There appears to be some conflict in opinion regarding the association of the accumulation of fat with the decline in glandular activity.

New diagrams illustrating the transformation period of the human spermatid, as prepared by the late Professor Bowen, L. B. Arey (*Anat. Rec., 47 (1930), No. 1, pp. 31–38, figs. 11*).—This is a presentation of diagrams of human spermatozoa formation with explanations.

FIELD CROPS

[Field crops work in Georgia, 1930] (*Georgia Sta. Rpt. 1930, pp. 8–21, 33, 34, figs. 4*).—Selections from Purplestraw wheat continued to outyield commercial varieties. A promising selection from Hybrid 49 (Purplestraw×Kanred×Purplestraw) was characterized by high yield, earliness, rust resistance, short stiff straw, and plump kernels. Several selections from Purplestraw×Hussar combined resistance to bunt with good yields and resistance to leaf rust in the field. In selfed rye a marked correlation was observed between the fertility of the parent and the progeny, and some of the selfed lines showed marked rust resistance. A plant of wheat×rye×rye was fairly fertile when allowed to open pollinate but failed to set seed when selfed; the plant was fertile when back-crossed to rye but did not produce seed when back-crossed to wheat. Sweet corn selected from hybrids between sweet and dent corn grew much more vigorously than the parent sweet corn and produced fair yields in spite of drought. Outstanding soybean selections were superior to parent varieties in numerous ways.

Cowpeas sown immediately after grain was cut made a thick and abundant stand, whereas a thin stand and small growth occurred when planted on stubble three weeks after grain harvest. A good stand of crimson clover was obtained by the use of an ordinary disk harrow leaving small shallow grooves in the soil. Top-dressing with potash did not appear desirable for wheat on the soil.

Treatment of cottonseed with an organic mercury compound greatly increased germination in early plantings but not in medium or late plantings. The increase in yield of seed cotton due to such treatment rose as the planting rate was increased from 6 to 10 pk. per acre. A rate of 2 or 4 pk. gave no increase. The germination of cottonseed in heavily fertilized soil compared favorably with that in unfertilized soil when high moisture conditions prevailed under paper mulch, but fertilizer injury was serious without mulch and with the lower contents of soil moisture. When about 3 weeks old the checks receiving no fertilizer were very tall and spindling with poor root development. Cotton on fertilized plats with no fertilizer injury apparent was short and stockier and had a much better developed root system, while plants injured by fertilizer were very much dwarfed and the leaves were badly crinkled. Indications were that fertilizer injury in the field may best be avoided by applying the fertilizer 10 days before planting. Stirring the fertilizer and bedding when the fertilizer was applied 10 days before planting gave a slightly better stand than not stirring. Small quantities of limestone had a marked effect in increasing the stand when combined with acid-forming nitrogen carriers such as ammonium sulfate and urea, but with sodium nitrate no increase in stand was observed. Variety-date of planting tests are also noted. Cotton variety trials have been reported on earlier (E. S. R., 64, p. 533).

Experiments with cotton on the clay soil of the Piedmont consistently favored application of limestone, best results being had with nitrogen from acid-forming carriers. On the sandy soils of the Coastal Plain there was either no increase or else a decrease in seed cotton yields from limestone. Other fertilizer work with cotton included comparisons of nitrogen carriers, time and methods of applying nitrogen and potassium and complete fertilizer, largely noted from another source (E. S. R., 64, p. 534), and tests of vetch as a green manure for cotton.

Although cotton matured when grown in solutions prepared with distilled water and chemically pure salts containing nitrogen, potassium, calcium, magnesium, phosphorus, sulfur, and iron, plants grown in the same solutions with

added traces of manganese, boron, copper, and zinc appeared more normal, had larger bolls, and a lower percentage of immature seed. Plants grown in winter were very high in nitrogen content compared with those grown in the same solutions in summer, especially with ammonium salts providing the nitrogen. The nitrate nutrient solutions produced more dry matter in the first 3 weeks of growth and again (E. S. R., 63, p. 128) contained about 100 per cent more calcium than those grown in ammonium salt nutrient solutions. The difference in dry weight was less evident at 6 weeks of age, and by the end of 14 weeks the plant heights of the two series were the same. Although ammonium salts for nitrogen reduced the calcium absorption by one-half, there was no evidence that calcium reduced the absorption of ammonia. Plants grown in ammonium salt solutions contained one-half as much magnesium and in the first 6 weeks absorbed more sulfates than those grown in nitrate solutions, but the nitrate plants absorbed more in later growth stages. In early growth stages plants grown in the nitrate nutrient increased the H-ion concentration of the solution, but after about 6 weeks their influence on the reaction of the medium was not noticeable.

[Crop experiments in Indiana] (*Indiana Sta. Rpt. 1930, pp. 14–17, 18, 82, 83, 84, figs. 4*).—Results of a 6-year test on light fine sand soil near Culver indicated that on droughty soils of this type manure can be used to best advantage on wheat or divided between corn and wheat. In a 3-year rotation of corn, wheat, and mixed hay there was very little variation in the increases on the corn but a distinct advantage on the wheat from applications directly to the wheat or on corn and cultivated in. A consistent advantage also was shown on the clover crop in better stands and increased hay yield.

Spring top-dressing experiments with various nitrogen carriers indicated that such practice is effective and practical in increasing wheat yields and lowering the cost per bushel. Materials applied at rates supplying 15.5 lbs. of nitrogen per acre when wheat was from 3 to 4 in. high resulted in increases averaging about 5 bu. The best gains came from calcium nitrate and from a mixture of one-half sodium nitrate and one-half ammonium sulfate. Similar trials with sodium nitrate at six different points in Indiana during 3 years showed an average increase of 5.8 bu. from 100 lbs. per acre application. The tests indicated that medium early applications may be expected to give the larger yield increases without increasing the protein content, whereas later applications increased the protein but returned smaller yield increases. The largest and most consistent gains in yield were had on sandy loam soils. In wet backward seasons fertilizer treatments, especially in the row or hill, have been most effective in speeding up maturity of corn. Lime, manure, and fertilizer resulted in increased yield and better quality during 6 years. Tests on the Moses Fell Annex Farm indicated that the use of 500 lbs. per acre of high-grade fertilizer would give profitable returns with tobacco.

The total values of 10 crops on land tile drained 24, 30, 36, and 42 in. deep over that undrained except by furrows usually increased with the depth of the tile. Corn on land disked shallow averaged in 6 years 35.1 bu. per acre, disked deep 50.6, and plowed 60.5 bu.; for soybeans the 5-year average yields were 16, 18.8, and 22.3 bu., respectively. The additional cost of preparing the seed bed by plowing appeared to be justified.

[Farm crops experiments in Iowa] (*Iowa Sta. Rpt. 1930, pp. 11–14, 24, 25, 26, 27, 31, 32, 50, 51, 57, 58*).—Strains of red clover grown in Iowa for some time or in States with the same climatic conditions were found satisfactory for the State. The plowing under of sweetclover at different times in the year suggested that in order to secure as great value as possible from sweetclover as green manure and avoid excessive volunteering it is desirable to delay

plowing until late in April of the second year. Comparisons in the field during three years indicated that it is not advisable to cultivate alfalfa in sections where bacterial wilt is prevalent, since the cultivation seems to spread the organisms and also to break the root surface, giving them a point of ingress. Reed canary grass in 4 years' comparison outyielded the best other hay grasses by 50 per cent and in the driest year by as much as 100 per cent.

Inoculated plats of soybeans grown on Grundy silt loam, an acid soil extensively developed in southern Iowa, yielded twice as much hay and about three times as much seed as uninoculated soybeans. The protein content of the hay was doubled and that of the seed was increased one-third by inoculation. Increases in yield and in protein content of soybeans with inoculation were greater when the soils had been limed enough to neutralize the acidity. The Illini soybean developed by the Illinois Station appeared superior to any variety currently grown in Iowa.

A survey of the acreage planted to different varieties of small grain indicated that over 55 per cent of the Iowa oats acreage was planted with varieties originated at the station. Iogold oats was increasing rather rapidly in acreage, and this variety might largely replace the acreage planted to Iowar, Iowa 105, and Iowa 103. Iobred wheat occupied about 20 per cent of the wheat acreage and Ioturk under 5 per cent. Official production figures confirmed the results of a previous survey (E. S. R., 64, p. 825), showing that at least 10 per cent of the current corn acreage was planted with high-yielding strains located through the State corn yield test. The heating of small grain in bins, probably due to increased respiration of the seeds and respiration of mold and bacteria growing under the conditions, and its control by drying are discussed briefly.

In the 1929 State corn yield test, the average yield of the hybrid entries was higher than that of the highest open-pollinated strains in each section. The best hybrid entry outyielded the best open-pollinated entry in every district from 5 to 17 per cent. Using the Krug variety as the mother parent and five or six inbred lines as sires demonstrated that the yield of the standard variety is increased from 5 to 20 per cent, largely because the inbred sire could cause an ear to develop on practically every stalk in the progeny. This system seemed to eliminate largely all barren and unproductive stalks, and certain inbred sires also decreased the amount of disease in the progeny. Smut, Diplodia, and basisporium diseases in some Krug × inbred crosses were decreased noticeably.

The inherited weak-stalked strains of corn were found to possess a higher moisture content and a much lower amount of cellulose, lignin, pentosans, and water-soluble material. Normal lignification also appeared to be restricted somewhat in the weak individuals. Breaking strength data on the stalks indicated a possible relationship with the ability of the plant to stand erect until after maturity. Coefficients of correlation for the breaking strengths with the percentage of plants broken in the field among the selfed lines were for the third internode —0.5766, fourth —0.5588, and the fifth internode —0.4915.

On quack grass in Story County sodium chlorate was most effective when applied June 20 and August 20, and two applications of 200 lbs. per acre killed the weed, although three 100-lb. applications also were effective. Spring and summer applications tended markedly to inhibit the growth of annual weeds until the following spring. The cost of sodium chlorate seemed to prohibit its use on areas exceeding 0.5 acre. Leafy spurge was reported as becoming widespread, covering in one case about 200 acres, where it was crowding out bluegrass and oats and was proving a menace to corn.

Report of the Holly Springs Branch Experiment Station, 1930, T. F. McGehee and O. B. Casanova (*Mississippi Sta. Bul. 286 (1930), pp. 19, figs. 2*).—Experiments with field crops (E. S. R., 63, p. 28) reported on for 1930 and in some phases for periods of several years, largely planned and conducted by C. T. Ames, comprised variety tests with cotton, corn, and vetch; fertilizer tests with cotton on hill and valley land and comparisons of sources of nitrogen, phosphorus, and potassium; lime requirement studies; spacing tests with cotton; crop rotations; comparison of the effect of crop rotation v. continuous cotton upon soil fertility; and trials of winter cover crops.

[Field crops investigations in North Carolina, 1929–30], C. B. Williams (*North Carolina Sta. Rpt. 1930, pp. 53–55, 56, 60, 61–63, 64, 66, 71–76, fig. 1*).—Outstanding varieties in comparative tests (E. S. R., 63, p. 629) at the station and substations included Biggs Two-ear and Weekley Improved corn; Fulcaster wheat; Lee and Fulghum oats; Tokyo, Herman, Virginia, and Mammoth Yellow soybeans for seed, and Otootan, Laredo, Herman, and Biloxi soybeans for hay; western strains of common and Grimm alfalfa; White Stem Orinoco tobacco for sandy soils, Cash for heavy and more fertile soils, and Jamaica and Bonanza for intermediate conditions; Tennessee Anthracnose-resistant red clover; Kobe and Tennessee No. 76 lespedeza; Improved Spanish 2 B peanuts; and *Crotalaria sericea*, *C. incana*, and *C. striata*. Breeding work with corn, wheat, soybeans, peanuts, and potatoes; fertilizer tests with potatoes (E. S. R., 64, p. 29), sweetpotatoes, tobacco, peanuts, soybeans, and red clover; cultural (and planting) tests with corn, wheat, soybeans, and peanuts; and fertilized crop rotations also are reported on. In many cases the experiments were in cooperation with the U. S. Department of Agriculture.

Urea led the synthetic nitrogen carriers for tobacco, although a mixture of several carriers usually surpassed single sources. Recommendations were that as much as 50 per cent of the nitrogen be derived from organic sources. The more liberal applications of potassium proved beneficial in most cases. Curing studies indicated that more uniform heat control could be had by employing more pipes or flues in the barn than are currently used. With well constructed barns of wood or fire-resistant materials and the use of more pipes well placed in the barn, fuel consumption as well as fire hazards may be reduced materially.

Difficulty often experienced by farmers in getting sweetpotato sprouts to live after using large quantities of fertilizer at or just before transplanting was overcome largely, if not entirely, by applying the fertilizer after the plants were set and rooted. Applying one-half the fertilizer before transplanting and one-half later was found to eliminate most of the injury. Mixtures deriving their potassium from low-grade carriers, such as kainit, were much more injurious than when the potassium came from the chloride. Urea as a nitrogen carrier was not so injurious to young plants applied in a complete fertilizer at transplanting as was sodium nitrate.

Peanut tests on Norfolk and Coxville fine sandy loams gave indications that fertilizers are profitable for peanuts when grown on a poor soil following a crop not fertilized heavily, but that little or no response is secured on very fertile soils. Potassium seemed most essential for most profitable production. The use of from 300 to 400 lbs. per acre of gypsum applied uniformly on the foliage was profitable especially in dry seasons. The use of lime only resulted in increased yield on Coastal Plain soils having a pH of less than 6. When fertilized and unfertilized peanuts on Norfolk sandy loam were variously limed, dusted with gypsum or sulfur, or barium carbonate, or sprayed with Bordeaux, fertilized plats had less leaf spot and yielded better, and the grade of unshelled peanuts was improved. The several treatments had slight effect on the amount of shedding. In spacing tests Virginia Bunch in 3-ft. rows yielded best with

4-in. spacing one plant per hill, and 8 and 12 in. two plants per hill, while with Jumbo Runner the best distance was two plants 12 in. apart and two plants 16 in. apart. The very thick spacings reduced yield and increased the number of one-seeded pods.

With soybeans grown on Bladen fine sandy loam, fertilizer mixtures with relatively high percentages of phosphorus and potash materially increased yields over unfertilized plats. Soybeans responded only slightly to additions of 100 lbs. per acre of manganese sulfate in the fertilizer, whereas limestone was the most effective material added in increasing yield and quality. The largest average yields were obtained when complete fertilizer, limestone, and manganese sulfate were applied together. Corn in rotation with soybeans did not give increased yields when the soil was rolled before planting at the Blackland Substation. Deep plowing (8 in.) was neither very beneficial nor injurious compared with 4-in. disking.

[Agronomic experiments in Wyoming] (*Wyoming Sta. Rpt. 1930, pp. 4–8, 30–32, 33, 34, 35, 36, 37, 38–40, 41, 42*).—Variety tests with wheat (E. S. R., 63, p. 135), oats (E. S. R., 63, p. 132), barley, corn, potatoes, alfalfa, sweetclover, and miscellaneous forage grasses; trials of forage mixtures for hay and pasture; comparisons of dry land v. irrigated seed and seed treatments with potatoes; cultural (including planting) tests with wheat (E. S. R., 63, p. 732), barley, alfalfa, sweetclover, and sugar beets; fertilizer trials with oats and potatoes; crop rotations; and weed control studies are again (E. S. R., 63, p. 130) reported on from the station and substations.

Fall plowing 5 in. deep at Gillette resulted in larger spring wheat yields than from any of 8 other methods of seed bed preparation. Winter wheat made its highest yields drilled September 1 on summer fallowed land. Winter wheat yields on corn ground at Sheridan were as good as on fallow and 50 per cent higher than on land in summer grain the previous year. Oats yields differed little at Worland on spring plowed or fall plowed land, whereas barley usually yielded best on spring plowing.

The meadow mixture of crested wheatgrass, timothy, and red clover was outstanding currently and over a period at the station, and a combination of the two grasses with alsike clover was next. Close seeding returned much better yields of alfalfa at Gillette and Sheridan and more sweetclover at Gillette than plantings in wide rows. Both crops responded well to inoculation at Gillette. Vine-selected seed of Great Northern field beans at Worland produced 1,660 lbs. per acre and seed from commercial stock 1,550 lbs. When close to windbreaks at Archer forage crops, especially crested wheatgrass and alfalfa, were very materially benefited, whereas grains, potatoes, and beans were reduced in yields.

Safflower grown at Worland in cooperation with the U. S. Department of Agriculture with rather light seeding made over 1,300 lbs. of seed per acre. The seed contains from 25 to 30 per cent of oil, compared with 30 to 35 per cent in flaxseed. However, the yield of flaxseed was less than that from safflower at Worland. Safflower apparently is not subject to wilt and may replace flax in many areas. Its oil is quite similar to linseed oil, hardens when exposed to the air, and can be used for paints and varnishes.

The water requirements of certain crop plants and weeds in the northern Great Plains, A. C. DILLMAN (*Jour. Agr. Research [U. S.], 42 (1931), No. 4, pp. 187–238, figs. 13*).—Water requirement studies were made with crop plants and weeds at Newell, S. Dak., from 1912 to 1918 and at Mandan, N. Dak., from 1919 to 1922.

The weighted mean water requirements (units of water required for the production of one unit of dry matter) were for the years indicated in paren-

theses, for Kubanka (durum) wheat (11) 430; the common wheats Marquis (1) 403, Kota (1) 447, and Hard Federation (1) 460; Swedish Select oats (2) 536; millet, average of 4 varieties, (9) 254; Dakota Amber sorgo (6) 288; Red Amber sorgo (3) 253; Sudan grass (6) 335; bromegrass (4) 784; crested wheatgrass (2) 853; western wheatgrass (2) 1,183; sugar beets (1) 304; flax, average of 6 varieties, (2) 668; alfalfa, average of 5 varieties, (10) 798; Grimm selections 795 to 850; Turkestan alfalfa (5) 887; Baltic alfalfa (6) 823; yellow-flowered alfalfa (5) 702; witch grass (2) 254; Russian thistle (2) 224; redroot pigweed (2) 261; purslane (1) 288; and lamb's quarters (1) 435.

The determinations of the water requirement of related strains of alfalfa, millet, and sorgo, selected by the author for adaptation to dry land conditions, indicated that small but significant differences exist in the water requirement of different varieties of the same crop. However, since the water requirement value in pot experiments as usually conducted is determined under adequate soil moisture supply, it probably is not a dependable measure of the adaptation of the variety to drought conditions. The water requirement of related strains of millet and alfalfa did not show significant differences over periods. Since pot experiments are subject to errors of experimentation, especially in factors affecting plant yield, it seemed doubtful whether the water requirement could be used as a precise measure of the value of related strains, although they do indicate the wide range of values of different crop plants. In most years a significant relation was apparent between the water requirement of Kubanka wheat and the yield of grain in the field.

Growth and yield of certain Gramineae as influenced by reduction of photosynthetic tissue, K. W. Parker and A. W. Sampson (*Hilgardia [California Sta.], 5 (1931), No. 10, pp. 361–381, figs. 8*).—The effects of removal of tops on root growth and on yield and on the regeneration of aerial growth and the growth rate and the yield of nonharvested (undisturbed) plants were studied in water cultures with *Stipa pulchra* (E. S. R., 64, p. 435), a native perennial bunch grass, and with *Bromus hordeaceus*, an annual species native to Europe.

During the 120-day period the growth rate of *B. hordeaceus* was more vigorous than that of *S. pulchra*, resembling the behavior in the natural habitat. A single harvesting during this period resulted in a temporary cessation of root growth, this being the more pronounced in *S. pulchra*, due possibly to the more rapid and vigorous growth of both tops and roots of *B. hordeaceus* and the fact that it completes its cycle of development much quicker. After each harvesting, regardless of the developmental stage, regeneration of the aerial portion took place at once in both species. Frequent harvestings 15 days apart over the 120 days harmed *S. pulchra* more than *B. hordeaceus*, although both species when harvested at these intervals produced much less dry material than when unharvested. A single harvesting before the final harvest at the end of 120 days affected slightly the total quantity of herbage produced for the entire period. The smallest yields in both species were obtained when the herbage was removed at the time of the maximum growth rate.

In so far as these studies represented growth and response to stimuli under natural conditions, they seemed to indicate the loss resulting from frequent removal of herbage, as by grazing or cutting, as well as of heavy grazing during the most rapid growth, practices which result in an appreciable decrease in yield. They were also indicative of decreased longevity of perennial bunch grasses and the curtailment in the establishment of such desirable species leading to a succession toward the climax or subclimax community.

Maryland grasses, J. B. S. NORTON (*Maryland Sta. Bul. 323 (1930), pp. 249–326, figs. 7*).—The true grasses, especially the wild species, occurring in Maryland and their intrastate distribution are recorded, with notes on economic importance, brief descriptions, and keys to aid in identification.

Winter grain pasture yield and utilization, H. H. FINNELL (*[Oklahoma] Panhandle Sta., Panhandle Bul. 26 (1931), pp. 9–14*).—Winter barley yielded 67 per cent more pasture on summer fallowed land and 72 per cent more on stubble land than did winter wheat in the fall, winter, and early spring pasture season of 1930–31. The herbage wasted by a cow in grazing averaged 8.9 lbs. of air-dry matter per acre for barley and 14.4 lbs. for wheat or 1.6 and 4.9 per cent, respectively, of the estimated quantities cropped from the barley and wheat plats. The barley pasturage with a crude protein content ranging from 31.8 to 32.7 per cent equaled or exceeded wheat pasturage in this respect when moisture was reduced to 10 per cent.

Lodging in oats and wheat, F. A. WELTON and V. H. MORRIS (*Ohio Sta. Bul. 471 (1931), pp. 88, figs. 39*).—Research on environmental, physical, chemical, and anatomical factors concerned in the lodging of oats and wheat has been noted earlier as to the principal conclusions (E. S. R., 59, p. 326). Lodging in these studies refers to grain partly or completely fallen over as a result of factors other than mechanical impact including violent wind, rain, and hailstorms. Many pages of the present publication not in the earlier account deal with the relationship between lodging and cultural practice and climatic conditions, as observed on station plats, and suggested remedial measures.

Lodging may be avoided, so far as the situation is amenable to control, partly through the seed used and partly through the handling of the soil. In seeding tests plants from the heavier rates or from the smaller seeds often lodged, while those from the lighter rates or larger seeds, respectively, remained erect. The stiff-strawed varieties usually were observed to tiller sparingly, and consequently to establish a relatively thin stand of comparatively strong, coarse culms. Clipping tended to reduce the number and height of culms and hence to prevent lodging but was not deemed highly successful, since much depends on the character of the subsequent season.

As to the soil, some relief evidently could be had by observing the point in the rotation at which the fertilizer is applied. However, the most helpful practices appeared to be those tending to reduce temporarily the available fertility, particularly the nitrates, as with a straw mulch. A rotation in which gross feeding crops like corn and soybeans preceded the small grain crop seemed preferable to one wherein a legume like alfalfa predominates. Plowing rather than disking or no seed bed preparation was found to result often in increase of soil nitrates and culms per acre and often to make the difference between lodging and nonlodging.

Quality of alfalfa hay in relation to curing practice, T. A. KIESSELBACH and A. ANDERSON (*U. S. Dept. Agr., Tech. Bul. 235 (1931), pp. 26, figs. 4*).—To determine the manner and extent to which the quality of alfalfa hay may be influenced by the mode of curing and to establish the basic principles of good curing practice were the purposes of investigations carried on by the Nebraska Experiment Station in cooperation with this Department. The plat and sampling technic is described in some detail. See also an earlier report (E. S. R., 56, p. 734).

Important considerations in practical plans for hay curing are held to include leaf conservation and avoidance of needless damage due to rain. Loss from leaf shattering results in actual reduction in the yield and quality of the hay. In the tests the leaves constituted 47 per cent of the entire crop, and their protein content was 141 per cent above that of the stems. The relation of leaf-

ness to protein content and feeding value was shown by the average correlation coefficient of 0.864±0.011 between leafiness and protein content. The avoidance of unnecessary rain damage probably is best accomplished by methods that hasten evaporation of moisture from the alfalfa and thereby shorten the interval between cutting and storage.

No marked difference was observed in curing time or in hay quality whether the cutting was in the morning, at midday, or in late afternoon, provided comparable swath curing preceded raking. Whatever the time of cutting, the alfalfa evidently should be raked before the leaves dry enough to cause much shattering. Ordinarily about 4 to 8 hours in the swath before windrowing facilitates rapid drying in hay cut in the forenoon or early afternoon. Favorable results may be expected by cutting in late afternoon and delaying raking until the dew has dried off the following forenoon. Raking immediately after the mower lengthened the curing period and lowered the color regardless of the type of rake or size of windrow. Overcured hay was 6 per cent greater in leafiness when raked in the morning while damp than when raking was delayed until midday.

Increase in size of windrow resulted in reduced curing rate, i. e., the evaporation was the slower as the mass increased, especially with immediate raking. In small, medium, and large windrows containing 2, 4, and 8 mower swaths, respectively, the hay required an average of 64, 80, and 92 hours to reach comparable cured condition when raked immediately after cutting, and when 4 hours of swath curing preceded raking, 50, 60, and 71 hours. Direction of raking with either type of rake, whether parallel or crosswise to the mower swath, or the direction of windrow did not affect materially the yield, rate of curing, or quality of hay. It appeared to make no difference in quality or curing rate whether the hay is windrowed with a side delivery or a sulky rake if comparable conditions be maintained.

Turning the windrows after 4 hours of windrow curing shortened the curing period 16 hours when the hay was raked immediately after cutting and 4 hours when raked 4 hours after cutting, and no change resulted in commercial grade. The side delivery rake was considered superior for turning windrows in case of rain or very slow drying weather.

Under Nebraska conditions, cocking of alfalfa hay as part of the curing process is not deemed advisable. The time required with cocking was increased nearly threefold compared with combined swath and windrow curing. Cocking did not appreciably improve the color, leafiness, protein, or other properties of the hay, and because of rain and slow drying, it often resulted in musty or moldy forage of Sample grade.

Turning or scattering partly cured windrows or cocks wet from rain shortened the curing period an average of 28 hours and had practically no effect upon color, leafiness, or protein content, although more cases of Sample grade due to mustiness developed where the hay was not turned. Hay rained on, although exposed much longer in the field with a lower color value resulting, contained slightly more protein than hay not exposed to rain.

When hay was dried in 2.75 hours with heated air by a forced draft (E. S. R., 62, p. 176), it did not differ much in quality from that requiring 127 hours for curing indoors, and it was little higher in color, leaves, and protein than hay field cured by a favorable combination of swath and windrow curing. A poultry feeding comparison in which artificially dried and field cured alfalfa from these studies were included in a basic ration lacking in vitamin A resulted in no significant differences.

Investigation of the removal of moisture from the stems of cut alfalfa during curing indicated that neither bleeding from the cut end nor transpiration by a

continuation of normal leaf functioning are appreciable factors. The internal moisture appeared to exit by direct evaporation through the stem epidermis, which is well supplied with stomatal apertures.

Double-crosses of corn for distribution in Minnesota, H. K. Hayes, I. J. Johnson, and R. F. Crim (*Minnesota Sta. Bul. 275 (1931), pp. 14, figs. 5*).—The characteristics of double crosses of corn (E. S. R., 63, p. 634) approved for distribution in Minnesota, the method of production, and their behavior in 1930 in cooperative comparisons with farmers are summarized, with a list of seed available in 1931 from selfed lines and first crosses.

In sections where the crosses were expected to prove adapted, they outyielded the farmers' variety in 166 of 203 comparisons and made less in 37 trials, averaging 12.3 per cent over the farmers' corn. In the southern section the crosses outyielded the farmers' corn in 61 comparisons and made less in 36 trials, averaging 4.9 per cent more. It appeared that thicker planting of the double crosses on heavy soils in south central and southern Minnesota would give heavier yields. For yields of from 80 to 90 bu. per acre from 4 to 5 plants per hill seemed necessary. The crosses also matured several days earlier than Minnesota No. 13 or Rustler White Dent, this being apparent in the earlier silking of the crosses and the lower percentage of moisture at harvest. The crosses matured much more uniformly than the normal corn.

Farm study of the cotton plant, J. W. Hubbard (*U. S. Dept. Agr., Farmers' Bul. 1661 (1931), pp. II+18, figs. 7*).—The principal parts of the cotton plant and their growth habits and functions are described for growers.

[Cotton research in North Carolina], C. B. Williams (*North Carolina Sta. Rpt. 1930, pp. 51, 52, 53, 60, 61, 66–70, 76, 77, fig. 1*).—Of several seed coat characters in cotton, smooth seed (*SStt*) were found to be dominant in inheritance to all types of fuzz, and the fuzzy tip (*ssTT*) dominant to complete fuzziness (*sstt*) but recessive to entirely smooth.

Concentrated fertilizer mixtures were as effective on cotton as the ordinary mixture of commercial materials on Norfolk sandy loam in Wayne County and at the Upper Coastal Plain Substation, but the commercial mixtures were superior at the station on Cecil clay loam. Application of the concentrated mixtures, one-half before planting and one-half after chopping, in Wayne County, was less injurious to young seedlings and gave higher yields than applying all the concentrated fertilizer before planting. Application of all mixtures 10 days before planting at the station gave an increase of 1.1 per cent in yield over applying all at planting time. Adding the fertilizer 10 days before planting gave better control of fertilizer injury in 1929 than did any other method tested at the Upper Coastal Plain Substation.

Comparisons of various proportions of organic and inorganic nitrogen showed, with ammonium sulfate and Leunasalpeter, the highest acre yields of seed cotton at 80 per cent with 20 per cent from cottonseed meal, and with sodium nitrate 65 and 35 per cent. Similar tests were made also in Franklin County.

The net increase in labor efficiency in cotton production from fertilized over unfertilized cotton was found on an average to be 1.8 times for coastal plain and 2 times for Piedmont soils of North Carolina.

Other activities with cotton included variety tests (E. S. R., 64, p. 832), improvement work, and fiber investigations.

Commercial fertilizers for cotton, 1925–1930 (*Mississippi Sta. Bul. 289 (1931), pp. 30, fig. 1*).—The results of fertilizer trials with cotton (E. S. R., 64, p. 628), since 1925 at the station and substations and in cooperation with farmers, indicate fertilizer formulas for important soil areas outside the Delta. The formulas probably most profitable for the northeast prairie types are for

black prairie 8-4-0 (N-P-K), red prairie 8-8-4, and sandy bottom soils 4-8-8; for shortleaf pine, northeast highland, flatwoods, and longleaf pine areas 8-8-4; and for brown loam soils—hill land 8-8-8 and bottom land 4-8-8.

Oats in the Northeastern States, T. R. STANTON and F. A. COFFMAN (*U. S. Dept. Agr., Farmers' Bul. 1659 (1931), pp. II+18, figs. 9*).—Superseding in part Farmers' Bulletin 892, entitled Spring Oat Production (E. S. R., 38, p. 340), information is given on the soils, fertility, rotation, cultural, and harvesting requirements of oats in the Northeastern States. New and improved varieties and strains and standard varieties suitable for the region are described briefly.

Variety tests of sugarcanes in Louisiana during the crop year 1928–29, G. ARCENEAUX and R. T. GIBBENS (*U. S. Dept. Agr. Circ. 162 (1931), pp. 24*).—Further varietal trials with sugarcane (E. S. R., 62, p. 333) showed P. O. J. 213, both as plant cane and stubble, continuing to lead the four released varieties in cane and sugar yield per acre and adaptability to Louisiana conditions, although lodging very badly in exceptionally rich soil or when overfertilized. P. O. J. 234 continued to lead in yield of sugar per ton of cane, comparing favorably with P. O. J. 213 as to yield of sugar per acre and exceeding it in several instances. P. O. J. 36 continued to ripen late and, while giving rather good results in the western part of the sugar belt, seemed the least desirable of the four released varieties. P. O. J. 36–M, ripening earlier than P. O. J. 36, appeared to be distinctly better adapted to Louisiana conditions.

Co. 281 plant cane almost equaled P. O. J. 234 in indicated yield of sugar per ton of cane, and it equaled P. O. J. 213 in yield of cane, and because of its much higher sucrose and purity afforded indicated sugar yields varying from 200 to 1,000 lbs. more per acre. C. P. 807 again gave high yields of cane per acre, both as plant cane and stubble. In sucrose content, the plant cane compared favorably with that of P. O. J. 213, while a much higher cane yield resulted in indicated sugar yields per acre exceeding those from P. O. J. 213 by 1,000 to 1,500 lbs. The stubbling qualities of C. P. 807 appeared distinctly superior to those of P. O. J. 213. Mill tests showed that no particular difficulty should be encountered in milling cane of Co. 281 and C. P. 807 with the milling equipment usually found at Louisiana factories. Further tests indicated that C. P. 71–B, C. P. 123, C. P. 177, C. P. 766, U. S. 1444, P. O. J. 2354, and P. O. J. 2725, possibly excepting C. P. 766, would not prove suitable for commercial culture in Louisiana, and it was indicated that P. O. J. 2878 would not ripen sufficiently under Louisiana conditions to prove of commercial value.

Planting tests showed that as to sugar content P. O. J. 213, Co. 281, C. P. 807, and C. P. 177 afforded better results when planted early in October than later in the fall. Limited data indicated that little is to be gained by planting P. O. J. 36–M, Co. 281, and C. P. 807 in rows closer than the 5.5- to 6-ft. spacing common in Louisiana. Rate of planting tests with P. O. J. 213, Co. 281, and C. P. 807, while too limited for definite conclusions, indicated the importance of an adequate planting rate; two running stalks per row appeared to be the minimum quantity of sound seed cane that should be planted.

The germination of tobacco seed, J. JOHNSON, H. F. MURWIN, and W. B. OGDEN (*Wisconsin Sta. Research Bul. 104 (1930), pp. 15, pls. 4*).—The optimum temperature for the germination of tobacco seed appeared to be around 31° C. (88° F.), a satisfactory rate and percentage of germination occurring at ordinary room temperature. The rate slowed down at 35° and 14°, and 40° was lethal. Most standard American varieties could germinate in the absence of light, although the rate and percentage might be retarded considerably. In one comparison Sumatra failed completely to sprout in the absence of light, and Havana Seed varieties used were delayed markedly in rate or decreased in percentage of germination.

Germination tests over prolonged periods on lots of seed of different ages revealed wide differences in the number of years that a lot of seed could retain germinability. One lot germinated 25 per cent after 20 years. As tobacco seed ages, a gradual slowing up occurs in the rate of germination. Seed 6 to 8 years old germinated quite satisfactorily in rate, and seed even 9 to 12 years old might be used commercially with a probable delay of but 2 or 3 days in germination. With older seed germination may be delayed as much as 8 to 10 days, and some germination may continue for several weeks.

Studies of seed from pods of different varieties in different seasons grown in Wisconsin and in the Connecticut Valley showed that full-grown seed pods may be harvested while yet green and with the seeds white, with fair certainty that the seed may mature subsequently and germinate if properly dried and stored. Green pods not full grown will rarely if ever produce viable seed if harvested. Limited data indicated that freezing temperatures do not damage mature seed pods. Light frosts evidently will not damage seed even in full-grown green pods, although younger, partly developed pods may be injured.

Most seed grown by farmers and seed growers tested during 15 years germinated over 80 per cent, although from 10 to 20 per cent of the seed ordinarily germinated less than 60 per cent and must be classed poor or worthless. A tobacco seed cleaning machine readily removes the chaff, dust, and light immature seed from the heavier seed, and the germinating capacity of some seed lots, according to test results cited, may be increased as much as 30 per cent.

Commercial agricultural seeds, 1930, J. M. Bartlett et al. (*Maine Sta. Off. Insp. 138 (1930), pp. 66–101*).—The germination, purity, and weed seed content are tabulated for 508 samples of agricultural seed collected from dealers in Maine during 1930.

Impurities of Bromus inermis seed, O. A. Stevens (*North Dakota Sta. Bul. 247 (1931), pp. 16, figs. 5*).—Of the foreign seeds found in 1,849 samples of *B. inermis* of known origin examined from 1909 to 1929, inclusive, *Agropyron tenerum* appeared in 57 per cent of the samples, *A. smithii* in 46 per cent, and *Polygonum convolvulus* in 42 per cent. Quack grass (*A. repens*), the weed seed of most importance, was found in 16 per cent of the samples tested. Those found less frequently were *Avena fatua* in 26 per cent, *Brassica arvensis* 10, *B. juncea* 15, *Chaetochloa viridis* 29, *Chenopodium album* 29, *Cirsium undulatum* 16, *Hordeum jubatum* 17, *Lepidium densiflorum* 19, *Ratibida columnaris* 19, *Rosa pratincola* 15, and *Sisymbrium altissimum* 18 per cent. Of the crops commonly cultivated in the region seeds of barley were found in 17 per cent of the samples, flax 22, oats 27, rye 22, timothy 25, and wheat 34 per cent.

Seed of native plants characterizing *B. inermis* seed from North Dakota or adjacent territory, occurring in from 1 to 20 per cent of the samples, came from *Agrostis hiemalis*, *Anemone canadensis*, *Brauneria angustifolia*, *Carex festucacea*, *C. trichocarpa*, *Cirsium undulatum*, *Elymus canadensis*, *Erysimum asperum*, *E. parviflorum*, *Gaura coccinea*, *Hosackia americana*, *Lactuca pulchella*, *Lappula occidentalis*, *Plantago purshii*, *Poa palustris*, *Ratibida columnaris*, *Stachys palustris*, *Stipa viridula*, *Symphoricarpos occidentalis*, and *Teucrium occidentale*. *Agropyron tenerum* probably is more characteristic than either *A. smithii* or Elymus.

HORTICULTURE

[Horticulture at the Indiana Station] (*Indiana Sta. Rpt. 1930, pp. 53–57, 67–69, 74, 75, 82, 83, figs. 2*).—Observations on young fruit trees making their seventh year's growth showed that young trees do not set as high a percentage of their flowers as do older trees. Studies in apple storage showed that an increase in ozone in the atmosphere has no effect on the rate of development

of common fungus diseases and that it also has no beneficial effect. With concentrations many times the commercial there was a slight but consistent increase in respiration activity. Ozone had no effect upon the development of apple scald. Icing increased the efficiency of a common storage plant to a moderate extent.

Codling moth was greatly reduced by spraying, banding, and sanitation practices. Arsenate of lead in sulfur dust was not as good a protector against codling moth as was arsenate of lead in liquid sprays. Sulfur dusts were not effective in the control of apple scab in epidemic years.

Commercial fertilizer was not profitable on strawberry beds fertilized with stable manure. Ammonium sulfate increased the value of the crop in five of seven years. Summer and spring applications of fertilizer were about equally effective. Combined summer and spring applications were more effective but did not repay for the added cost. Adding 250 lbs. of potash to 500 lbs. of 2–12–6 fertilizer resulted in increased yields in three of seven cases.

Asters selected in 1927 for wilt resistance retained this characteristic in 1929. An apparently resistant selection of the Ostrich Feather aster was isolated in 1928.

Data are presented on the results of inspection work with fruits and vegetables. Early plowing, early planting, and the use of commercial fertilizers increased the yields of tomatoes. The U. S. No. 1 grade of tomatoes yielded a better colored canned product than did U. S. No. 2.

Studies conducted in cooperation with the Boyce Thompson Institute for Plant Research upon material collected from the various parts of the apple tree at various seasons are reported. From November 18 to December 18 free reducing sugars increased and starch decreased in all parts of the tree. Sucrose increased in the wood and decreased in the bark. Total, protein, soluble, and nonprotein nitrogen increased in the 1-, 2-, and 3-year wood, apparently at the expense of the older tissues. From December 18 to February 26 there was practically no change in the amount of free reducing substances in the top, but the small roots and root bark showed an increase. Starch decreased in the wood of the top and in the roots but increased in the bark. There was a small increase of sucrose in the roots, with little change in the top. An increase in total, protein, soluble, nonprotein, ammonia, amino, and amide nitrogen in all parts of the tree, suggested the absorption of nitrogen by the tree, especially since all parts of the roots showed a very large increase in soluble nitrogen. From February 26 to April 8 free reducing sugars decreased in all parts of the tree. Sucrose decreased in the wood and increased in the bark, thus reversing the early winter change. Starch increased markedly in all parts of the tree except in the small roots. All parts except the small roots showed a loss in total and protein nitrogen and an increase in soluble and nonprotein forms, indicating the hydrolysis of proteins. Small roots increased in total and protein nitrogen and decreased in all soluble forms of nitrogen. Large roots, bark, and wood showed a decrease in all forms of nitrogen, suggesting their translocation. From April 8 to May 18 free reducing sugars increased in the 1-, 2-, and 3-year-old twigs and decreased in the bark of the remainder of the tree and in the roots. Sucrose and starch showed a marked decrease in all parts of the tree. All forms of nitrogen decreased in all parts except that soluble nitrogen increased in the bark of the large roots. From May 18 to June 28 free reducing sugars and sucrose showed but little change. Starch increased markedly in all parts of the tree, accompanied by a decrease in nitrogen. From June 28 to July 29 there were no marked changes in carbohydrates or nitrogen, all parts being lowest in total nitrogen at this time. Phlorhizin and acid hydrolyzable water insoluble carbohydrates

showed no significant seasonal trends of importance, indicating that these substances are not important reserves.

Chemical analyses of 1-year-old twigs and of the terminal growth of apple trees in sod and under cultivation showed in 1927 the highest content of soluble and total nitrogen in the cultivated trees, whereas in 1929 there was an indication that the nitrate of soda applied to the sod had increased the nitrogen content of the sod-grown trees.

Determinations of the arsenic residue on apples taken from trees sprayed with lead arsenate showed an excess above the 0.015 grain per pound (United States tolerance). An apparent increase in arsenic between the time of the last spray and harvest is ascribed to residue washed from the leaves by the rain. The cost of erecting a stationary spray plant at the Moses Fell Annex Farm is briefly discussed, with comments on its efficiency.

Records taken in an air-cooled and an iced storage room during the late autumn showed that ice lowered the temperature by a maximum of 16.6° F. in late September to a minimum of 5.4° in the middle of October. With the prevailing market conditions of 1929 the entire crop could have been sold to advantage without storing. The iced fruit contained 4 per cent more sound material on December 16 than did that from the air-cooled room.

[**Horticultural investigations at the Iowa Station**] (*Iowa Sta. Rpt. 1930, pp. 32–36, 42, 43*).—Of six sprays used to combat apple scab, the standard lime sulfur gave the best results, 81 per cent control. The addition of iron sulfate to the lime sulfur solution did not make any noticeable difference in the amount of fruit injury present. Lead arsenate was included in all the sprays, and reduced codling moth injury from 57 per cent on checks to an average of 10 per cent.

The winter of 1929–30 was severe, causing much injury to the seedling pears. Four progenies of Orel 15 × Anjou 940 when pollinated by Flemish, Bartlett, Anjou, and Clapp Favorite produced seedlings showing marked hardiness. Studies of *Pyrus ussuriensis* hybrid seedlings showed but little promising material, even when Flemish, Howell, Bartlett, Sheldon, Warner, and Winter Nelis were used as pollen parents. Bartlett progeny contained the smallest percentage of small-fruited and low-quality seedlings and Sheldon progeny the highest.

Attempts to grow hardy apple stocks by planting seed of hardy varieties revealed marked differences according to parent in the number of seed per bushel of fruit, in the percentage of germination, and in the type of top and root growth. Covering the grafts with paraffin wax enabled the successful grafting of apples on July 12, 1929. The scions made 20 in. of growth the same season and survived the following winter in excellent condition. Among fruit seedlings developed by the station the Ames apple showed much promise in the upper Mississippi Valley, the Monona apple in New Jersey, and the Ames No. 11 peach in Glenwood, Iowa, where it withstood 25° below zero and fruited.

Cold storage investigations again showed that varieties of apples susceptible to soggy breakdown become peculiarly susceptible after exposure to rather high temperatures before storage. At 36° F. soggy breakdown was not a factor. Respiration studies with Grimes at 30°, 36°, 50°, and 60° suggested that the respiration rate in this variety follows a rather definite cycle. At 50° respiration increased rapidly until the fourth and fifth weeks, then decreased until the onset of senescence, when there was again a rapid increase.

Excessive callusing at the union in apple grafts was prevented by inserting the tip of the cut end of the scion into the stock and wrapping the union with adhesive tape. Even without the tape the improved technic greatly reduced callus growth.

A comparison of fiber pots with clay pots for growing vegetable plants showed but little difference where both were plunged into soil. With tomatoes more early fruit was harvested from clay pot plants, suggesting that these become reestablished more readily.

In reporting on progress in apple breeding, information is presented on the number of seedlings resulting from various seasons' work. Measurements taken on 1924 apple seedlings showed that from the start Antonovka seedlings from crosses with Jonathan, Grimes, Delicious, Ashton, and Black Oxford have been exceptionally vigorous. In contrast, trees of the Anisim × Black Annette and of Black Annette × Delicious were decidedly lacking in vigor. Antonovka crosses yielded a large percentage of stout limbed, vigorous trees. Monona, Sharon, and Hawkeye Greening are listed among promising seedling apples.

[Research in horticulture at the North Carolina Station], J. H. Beaumont et al. (*North Carolina Sta. Rpt. 1930, pp. 114–133, 134–137, figs. 9*).—Apple pruning investigations conducted by M. E. Gardner showed the greatest yields from light pruned trees in three of the four varieties under test. To date no significant differences have been recorded in the growth of young apple trees under differential fertilizer treatment.

As reported by C. F. Williams, I. D. Jones, and Beaumont, peach trees receiving nitrogen in addition to the regular fertilizer treatment contained a greater percentage of total nitrogen and a lesser percentage of carbohydrates throughout most of the year than did the regularly fertilized trees. However, in late winter and early spring more starch and nonreducing sugars were present in the high nitrogen trees. This condition was correlated with increased vegetative vigor in spring. Seedling peaches grown in pots and held at different temperatures were observed to assimilate nitrogen during apparent dormancy at temperatures above 40° F. As observed by Beaumont, Williams, and Gardner, young peach trees in the Piedmont area when unsupplied with nitrogen declined steadily in vigor, as indicated by measurements of the terminal and spur growths, and yielded only half the crop of the nitrogen-supplied trees. Peach pruning studies in the Piedmont section showed light pruning to give the largest yields of fruit of good color and size at the lowest pruning cost. Indications were that uniform light pruning every other year is essential. Variety tests at the Mountain Substation showed Premier and Warfield to be the most productive strawberry varieties under test.

Fruit breeding studies included observations on the progeny of spineless and ordinary dewberries. Certain of the seedlings were spineless or nearly so. Peach breeding was continued with the view to developing seedlings resistant to bacteriosis. Pruning experiments conducted by Williams on the dewberry showed that pruning back to the crown greatly reduced the number of new canes but also reduced the number of diseased canes. No appreciable differences were secured from various fertilizer treatments. Records taken by R. Schmidt and Beaumont in a strawberry fertilizer experiment at Calypso showed marked correlations, 0.63±0.077 between yield in 1929 and 1930, 0.745±0.067 between yield in 1929 and estimated yield, 0.937±0.016 between yield in 1929 and estimated vigor, and 0.318±0.021 between yield in 1929 and the grade of berries. The results of varietal tests with the rose, carnation, tulip, iris, narcissus, and other perennials are set forth by G. O. Randall.

As observed by Schmidt, fertilizers had no effect on the occurrence of tipburn in lettuce except as they influenced growth, the trouble being most prevalent on strong growing plants. A survey in the field did not reveal any apparent relationship between different fertilizer combinations, top-dressings,

and use of mineral or organic nitrogen fertilizers and the incidence of tipburn. Studies of the relation of environmental factors, as measured by the thermometer and atmometer placed in lettuce beds, to the occurrence of tipburn indicated an association between tipburn and relative humidity. A negative correlation of -0.551 ± 0.111 was recorded between evaporation and percentage of tipburn heads on the same day. Some relation was noted between daily maximum temperature and the percentage of tipburn the next day. Irrigation tended to increase tipburn injury. A number of strains of Big Boston lettuce were isolated, some with apparent increased resistance to tipburn.

Notes are presented by Schmidt and Beaumont on the results of miscellaneous varietal tests with vegetables.

Insecticides and fungicides, 1930, J. M. Bartlett et al. (*Maine Sta. Off. Insp. 138 (1930), pp. 102–108*).—The results are presented of the analyses of 53 samples of insecticides and fungicides collected by the State commissioner of agriculture in 1930.

Methods for determining the solidity of cabbage heads, O. H. Pearson (*Hilgardia [California Sta.], 5 (1931), No. 11, pp. 383–393, figs. 3*).—Several methods of determining the solidity of cabbage heads were tested and are comparatively discussed. Densities based on calculated volumes were in accord with those determined by water displacement, but variations as high as 25 per cent were obtained when geometrical methods were employed. The most successful method of determining solidity, that of measuring the buoyancy of the cabbage head when inclosed in rubber cloth, was found to permit duplication of readings within a maximum experimental error of approximately 6 per cent. Concerning time employed, the buoyancy readings were made at the rate of 3.5 minutes per head as compared with a minimum of about 10 minutes for the water displacement method.

Celery production on the muck soils of New York, J. E. Knott (*New York Cornell Sta. Bul. 517 (1931), pp. 37, figs. 11*).—Based on the results of a survey among growers and upon certain experimental data, there is presented a general picture of the cultural aspects of celery growing on the muck soils of New York.

In a series of cooperative trials conducted at Williamson in Wayne County on muck which had been cleared a few years, nitrogen applied at the rate of 105 lbs. per acre gave a significant increased yield of untrimmed celery over the nonfertilized plats. The use of phosphorus and potash without nitrogen decreased yields. Used with nitrogen there was a slight but insignificant increase. No difference was noted when dried blood or ammonium sulfate was substituted for all or part of the nitrate of soda. Phosphorus had little beneficial effect on yield; in fact, when used at the rate of 1,200 lbs. of superphosphate per acre yields were decreased below the nonfertilized plats. When phosphorus was used with nitrogen and potash, yields were greater than with phosphorus alone, indicating that the nitrogen and the potash were the effective ingredients. It is believed that nitrogen and potash may function in the absorption and utilization of phosphorus. The use of 195 lbs. of potash alone significantly increased yields above those of no fertilizer.

Survey data are summarized in relation to various practices, such as time, manner, and rate of seeding, fertilizing the seed bed, etc. Fertilizers of a 4–8–12 analysis were used by 40 per cent of the growers. Positive correlations were noted between increasing quantities of nitrogen, phosphorus, and potash and increased yields in the three age groups of muck considered. Most of the celery grown on the muck is of the Golden type. Copper fungicides were highly valuable in protecting celery seedlings from disease. Practical recommendations are included.

Head lettuce in western Washington, H. D. Locklin and G. A. Newton (*Western Washington Sta. Bul. 19-W (1931), pp. 37, figs. 7*).—A general discussion (by Locklin) of the cultural requirements of lettuce, methods of handling and marketing the crop, and (by Newton) of important diseases and their control.

Some common mushrooms and how to know them, V. K. Charles (*U. S. Dept. Agr. Circ. 143 (1931), pp. 60, figs. 49*).—This circular, a revision in part of Department Bulletin 175 (E. S. R., 33, p. 65) and Farmers' Bulletin 796 (E. S. R., 37, p. 263) and which it now supersedes, presents descriptive and other information on a large number of mushrooms, with illustrations in many cases. A key is presented for distinguishing the different genera of Agaricaceae.

Relation of foliage to fruit size and quality in apples and pears, J. R. Magness, F. L. Overley, and W. A. Luce (*Washington Col. Sta. Bul. 249 (1931), pp. 26, figs. 7*).—Seeking information on the amount of leaf area necessary to develop fruits to satisfactory size and quality, branches of Jonathan, Rome, Delicious, and Winesap apples and Bartlett, Anjou, and Winter Nelis pears were ringed just after the June drop and the number of remaining fruits regulated to certain definite numbers of leaves. The individual fruits were tagged and their circumferences determined at approximately 15-day intervals. Following harvest representative samples were taken for chemical analysis.

In the apples in no case did fruits with only 10 leaves attain satisfactory commercial size, and their total sugar content was consistently lower than with apples with more leaves. With 20 leaves fairly good sized apples were obtained, and with 30 leaves size was satisfactory in all varieties. Fruit bud formation did not occur on branches with 10 leaves per apple, was abundant in Jonathan and Rome with 20 leaves, and satisfactory in all four varieties with 30 leaves per fruit. Leaf size differed with varieties, Rome being the largest and Winesap the smallest.

Comparable responses were obtained with pears. Bartlett fruits on ringed limbs increased in size up to the maximum number, 60 leaves per fruit. Twenty leaves gave fair commercial size, and 30 desirable canning size. Approximately twice the number of leaves was required to obtain a given size in Winter Nelis as in Bartlett. At the same time the sugar content of Winter Nelis pears with any given leaf area was almost twice that of the other two varieties. Reducing sugar, total sugar, and dry matter increased with increased leaf area.

Since in unringed branches there is presumably a draft by the tree as a whole on the foods developed by the leaves, it is conceded that more leaf surface would be required to supply both tree and fruit than was shown with ringed branches, possibly 30 to 40 leaves where 20 to 30 suffice with ringing.

A study of apple tree growth as influenced by soil conditions in the Bitter Root Valley, E. Burke, H. E. Morris, and F. M. Harrington (*Montana Sta. Bul. 241 (1931), pp. 23, figs. 4*).—Chemical analyses of the soil from three different locations in the Bitterroot Valley showed an apparent lack of certain essential elements to be associated with unfavorable growth conditions known as winter injury and brown bark spot. Treatment of the soil at the Horticultural Substation with various fertilizers and combinations thereof showed the most rapid recovery where complete fertilizer was applied. Nitrate of soda gave good results, but when used alone phosphorus and potash apparently became limiting factors.

Investigations in 1924 in a clean cultivated orchard showed that nitrogen in the soil becomes available for growth much faster than utilized by young trees, so that 60 lbs. per acre-foot accumulated during the summer and was largely lost through leaching and denitrification. At Bozeman it was observed

that as much as 80 lbs. of nitrate nitrogen per acre was lost in the first 5 ft. of soil in May and June.

Faulty irrigation in which only one or two furrows were run for each row of trees is believed a cause of poor growth, since large areas were not moistened sufficiently to supply nutrients. Yellowing from water shortage was offset by applications of nitrate, and in a rainy summer no such yellowing was observed.

Cover crop experiments begun at the Horticultural Substation in 1908 in an orchard with 80 trees per acre and previously reported upon (E. S. R., 37, p. 241; 49, p. 833) are again discussed. Red clover not only maintained but actually built up the nitrogen of the soil, as was determined by analyses of soil from the several plats. The nitrogen content of the clover and of the manured plats increased until nitrogen was no longer a limiting factor. Coincident with the increase in nitrogen the manifestations of winter injury and bark injury decreased. However, it is deemed essential to supply the trees with a balanced plant food.

Bloom period and yield of apples, C. W. Ellenwood (*Ohio Sta. Bul. 472 (1931), pp. 21, figs. 3*).—Records taken on 159 varieties of apples in the station orchards over the 20 years 1910–1929 show that with few exceptions apple varieties overlap sufficiently in their blooming season to provide adequately for cross-pollination. The average length of the blooming season of standard apples was 10.3 days. On the basis of the 20-year average Ohio Nonpareil was the earliest bloomer and Ralls the latest.

Varieties are also divided into three groups in respect to age of profitable production. In the first group, 8 years or less, are found such well-known apples as Ben Davis, Jonathan, Stayman Winesap, and Wealthy; in the second group, 9 to 11 years, Delicious, McIntosh, Grimes, and Winesap; and in the third group, 12 years or more, Northern Spy, York Imperial, and Rhode Island. Varieties are also grouped with respect to their regularity of fruiting and capacity for yield. Among well-known apples the 10 highest yielders were Grimes, Northwestern, Rome, Rhode Island, Fallawater, Ben Davis, Baldwin, Winter, Banana, Jonathan, and Northern Spy.

Cultivated berries in Georgia, J. G. Woodroof (*Georgia Sta. Bul. 166 (1931), pp. 32, figs. 10*).—In connection with a general discussion upon botany and varieties, methods of propagation, training, general culture, control of diseases, and methods of handling and utilizing the crop, tabulated data are presented on the results of breeding work with various bush fruits. It was observed that a large proportion of the flowers that opened on any single day opened in the morning. On warm days single blooms remained in a favorable condition for emasculation for about four hours. Light was essential to the proper opening of flowers but apparently was less concerned with the ripening of the berries. Varying amounts of sterility were recorded in the progeny of the various crosses, ranging from 0 to 100 per cent.

Raspberry investigations: A preliminary study of the fruiting habit of the red raspberry, Rubus strigosus, R. V. Lott (*Colorado Sta. Bul. 367 (1931), pp. 41, figs. 19*).—Asserting that the peculiar conditions under which red raspberries are grown in Colorado, namely, high altitude, irrigation, and laying down canes in winter make growing problems different from those of the East, the author presents the results of a study of the fruiting habits in three varieties. Yields under the hill system of culture increased up to the maximum number of canes (10) utilized in the experiment and to the maximum height (48 in.) employed in 10-cane plants. The yield per cane decreased as the number of canes per hill increased and increased with the length of canes. The percentage of bearing buds decreased with an increased number of canes

per hill and increased with height of cane in 5-cane but not in 8-cane hills. As regards size of berry, length of fruiting shoots, and number of new canes over 0.85 cm. in diameter at 6 in., cane thinning or heading had no effect.

Dividing canes into 5-bud sections from the base upward, it was found that heading significantly increased yields per bud only in the fourth section. Cane heading did not significantly increase the weight per berry in any section. Nonheaded canes produced significantly larger berries in the second and third sections as compared with pruned canes.

Latham and Newman yielded more fruit per fruiting bud than did Cuthbert. The highest yielding buds were in the third section in Cuthbert and Newman and in the fifth section in Latham. Cuthbert berries were generally smaller than those of the other two and varied more in size from the base to the tip. A correlation between cane diameter and yield and possibly between cane diameter and weight per berry was noted in Cuthbert. Bud spacing was most uniform in the Latham and least in Cuthbert. Latham, Newman, and Cuthbert bore 91.05, 126.29, and 160.12 per cent more buds, respectively, in the 6-ft. than in the 3-ft. section, suggesting that severe heading may be of doubtful value. Based on the results practical suggestions are offered.

Black raspberry studies, R. E. Marshall (*Michigan Sta. Tech. Bul. 111* (*1931*), *pp. 32, figs. 15*).—Observing that the fruiting canes of the black raspberry suffered a rapid decline in vigor toward the end of the ripening season, studies were made of the expressed tissue fluids of the leaves of lightly, moderately, and severely pruned plants. In respect to freezing point depression, the juices of leaves of fruiting canes were materially greater than those of new canes and the rate of increase in freezing point depression with advance of the season was approximately twice as great in the fruiting canes, suggesting a greater osmotic concentration and ability for drawing water from the soil. Pruning did not materially affect freezing point depression, though there was some indication of a lowering in the leaves of the severely pruned canes. The leaves of fruiting canes had approximately 21 and 35 per cent more solids in mid-June and mid-July than did leaves of vegetative canes. Bound water was apparently higher in the leaves of the fruiting canes; hence the evidence did not support the hypothesis that reduced osmotic concentration in the fruiting canes may reduce the ability of the canes to obtain essential water in the latter part of the season.

Studies of the rate of water movement through excised parts of fruiting and vegetative shoots of the Cumberland black raspberry showed the fruiting canes to decline in their capacity to transmit water, so that at the close of the picking season they were transmitting only half as much water per unit period as they did when the berries were just formed. On the other hand, new shoots showed an increasing power of water transmission with due allowance for size changes. As regards pruning treatments differences were fairly consistent but not significant.

Selecting an apparently uniform field of 2-year-old Cumberland raspberries (correlation coefficient of 20.67 in the yield of individual rows) sulfate of ammonia was applied at various seasons with one superphosphate and one no fertilizer treatment for comparison. On the basis of foliage color the treatments were divided into three groups, dark green for those receiving nitrogen in the spring and in September, moderate green for those with nitrogen after harvest, and light green for no fertilizer, superphosphate, and nitrogen applied when the berries were turning red. In yield there were no striking differences. Only in one case did the odds by Student's method reach 22:1. There was some indication that nitrogen applied just after harvest in early September or in the spring about the time that growth started resulted in increased quan-

tities of early ripening berries. Differences in berry size were hardly significant. Rainfall was directly correlated with total yield and size of berries. There was a tendency for nitrogen applied just after harvest in early September and in the spring to increase the number of new canes produced per plant but to cause less elongation of these canes. Superphosphate apparently caused an increased rate of shoot growth after harvest. There was little correlation between the number of canes per plant and yield, and fertilizer had no effect on the diameter of the canes.

[The flowering habit of the pecan] (*Georgia Sta. Rpt. 1930, pp. 32, 33*).—Observations on numerous varieties of pecans growing under different environments indicated that the capacity for self-pollination varies from year to year. Studies in pecan orchards in North Carolina, Florida, and Georgia indicated that the number of varieties that are self- and cross-pollinated is about equally divided.

FORESTRY

[Forestry at the Indiana Station] (*Indiana Sta. Rpt. 1930, pp. 48–51, figs. 2*).—Some evidence was obtained in nursery work that zinc sulfate aids in the control of weeds. Loblolly pine did not prove hardy, and western yellow and shortleaf pines suffered some winter injury but recovered. Damping off injury varied with species from zero in treated Chinese arborvitae to a considerable percentage in red pine. Concerning the time of seeding, fall planting gave best results with white pine, early spring for red pine, and April for Norway spruce, Black Hill spruce, and Chinese arborvitae. With seed of 60 per cent or better viability, more weight of seed was needed for planting a given area with white pine than with the other species. Red pine showed greater loss in 3-year than in 4-year transplants.

Government forest work in Utah (*U. S. Dept. Agr., Misc. Pub. 99 (1931), pp. 18, figs. 8*).—Superseding Department Circular 198 (E. S. R., 46, p. 341), this pamphlet presents general information on the location, distribution, administration, and utilization of the national forests and forest areas in Utah, with special reference to timber and grazing privileges, recreation facilities, etc.

Reproduction on pulpwood lands in the Northeast, M. WESTVELD (*U. S. Dept. Agr., Tech. Bul. 223 (1931), pp. 52, pls. 8, figs. 16*).—Seeking practices that will support continuous production of pulpwood, observations were made on a large number of sample plats on various aged cut-over areas in different sections of the spruce region of northern New England and New York. On most of the areas, regardless of the severity of the cutting, an abundant reproduction of spruce and fir was found, nearly all of which was advance growth present in the stand prior to cutting. Quantitatively advance reproduction was greatest in the spruce-slope type, second in the spruce-flat, and least in the spruce-hardwood type. In general reproduction was greatest on areas which originally contained the greatest volume of spruce and fir. Abundant seed, favorable seed beds, and tolerance to shade by fir and spruce accounted for the abundant reproduction.

The extent to which advance reproduction benefited by cutting varied directly with the severity of the cutting. Competing hardwood growth was the most disturbing factor operating to prevent the reestablishment of spruce and fir and was particularly so in the spruce-hardwood type. Clear-cutting of spruce and fir retarded restocking and favored the hardwoods. Beech and sugar maple were particularly aggressive hardwood competitors of the conifers. Clear-cutting changed the composition of the new stand and increased fir at the expense of the more valuable spruce.

On cut-over areas spruce and fir germination was more profuse on exposed soil from which litter and plant growth was dragged away giving roots contact with the permanent water supply. Data taken on exposed plats showed 4,700 spruce and 22,500 firs, as compared with 1,700 spruce and 4,700 firs, respectively, on undisturbed soil. Hardwood leaf litter occasionally prevented seed germination. Moderately suppressed spruce and fir reproduction responded vigorously in height development following the removal of the overhead canopy, particularly the fir.

The character of the soil played an important rôle in the composition of the stand, conditions favoring hardwoods being unfavorable to spruce and fir simply because of the strong development of the former. Spruce and fir developed better than hardwoods on the spruce-flat soil type. Hardwood slash rotted much more rapidly than conifer slash, thus causing a longer fire hazard and greater impediment to reproduction in the case of the conifers. Burning of conifer slashings is deemed necessary, while similar treatment of hardwood slash is rarely justified.

An explanation of American lumber standards, C. V. Sweet (*U. S. Dept. Agr., Misc. Pub. 107 (1931), pp. 12, figs. 2*).—Brief information is given on the provisions and scope of standards adopted by a committee of lumber producers, distributors, and consumers working in cooperation with certain Federal agencies. Appended is a list of lumber associations issuing grade rules and maintaining inspection departments, and information concerning grades, grading, and factors influencing grades.

DISEASES OF PLANTS

Botany [at the Georgia Station] (*Georgia Sta. Rpt. 1930, pp. 27-29*).—No ascigerous stage was found in the case of *Cercospora personata*, the cause of a very destructive leaf spot of the peanut. Evidence was obtained that the spores are carried long distances by the wind.

Attempts to develop lines of the Globe tomato possessing immunity to Fusarium wilt were unsuccessful. Crossing resulted in some highly resistant but no entirely immune strains.

Attempts to transmit peach rosette by injecting juice from diseased into healthy trees and by various other mechanical means proved fruitless. However, when pieces of bark from rosetted trees were grafted onto healthy tissue the disease was transmitted quite as effectively as with buds.

No results were secured in preventing the infection of peppers by *Sclerotium rolfsii* by distributing disinfectants about the base of the plants. No gain in resistance was noted in seedling peppers grown from the seed of plants possessing apparent resistance, leading to the deduction that it is unlikely that the pimiento pepper possesses any heritable resistance to this fungus.

Some indication was secured that the new pepper fruit rot previously mentioned (E. S. R., 63, p. 841) is identical with *Vermicularia capsici*, said to be the cause of a serious disease on the chili pepper in India.

In the face of weather conditions highly favorable to germination, some indication was seen that seed treatment of cotton was profitable.

Halo spot of beans caused but little damage due to dry conditions, but clear evidence was obtained that the causal organism is the same as that on kudzu, where the bacteria overwinter in cankers on living tissue.

Studies on the control of downy mildew of cucurbits showed that the application of dry sulfur to the soil at the rate of 50 lbs. per acre proved injurious to the plants. Drought interfered with spraying results by killing the vines before they could produce a full crop.

[Plant pathology at the Indiana Station] (*Indiana Sta. Rpt. 1930, pp. 22–28, 73, figs. 3*).—Inoculation tests in the greenhouse upon 734 varieties of wheat showed 53 to possess resistance to the two physiologic forms of leaf rust utilized. Of a total of 135 selections resistant to physiologic forms 3 and 5, 48 were found to be resistant to a third form (9). Warden, Vernal emmer, Acme, and Buford showed resistance to all of the forms of rust studied. Of 38 varieties and selections of spring wheat and 167 of winter wheat exposed to infection in field plats at various locations, 15 showed marked leaf rust resistance. Tests of 179 rust-resistant wheat selections showed 39 yielding more than the control (37 bu.). Of 72 rust-resistant selections tested in another series, 14 yielded more than the control. Among 44 collections of leaf rust from 9 States, physiologic forms 3, 5, 6, 9, and 10 and 4 undescribed forms were the most common. The resistance of the Webster variety to physiologic forms 3 and 5 was found to be inherited as a simple dominant factor. The resistance of the variety Warden was added to that of the varieties Norka and C. I. 3756. The resistance of emmer and of rye was transferred by breeding to bread wheat types.

In general, conditions favoring food synthesis in the plant favored urediniospore production by leaf rust, whereas starvation favored the production of the overwintering teliospore stage.

Eighteen varieties of barley previously found to be resistant continued to show this characteristic. Two of 25 barleys imported from Australia proved to be resistant to two physiologic forms of rust common in the United States. Resistance in barley was found to be due to one main factor, usually dominant, which is fairly definitely inherited and inherited independently of such characters as hoodedness, glume color, hull-lessness, and the number of rows.

Inoculations upon 20 selections of rye showed 16 highly resistant to leaf rust. Of 120 selections received from outside sources, 3 showed outstanding rust resistance.

The resistance of corn to rust was found to be the result of a simple dominant character, the factor for which was not linked with that of any of a number of other characters studied.

Excessive nitrogen increased the susceptibility of the wheat plant to leaf rust, whereas phosphorus and potassium, separately or in combination, decreased susceptibility. Increasing both phosphorus and postassium had more effect than increasing either one alone. In the field, it was evident that the harmful effect of nitrogen consisted in lengthening the growing period and reciprocally the beneficial effect of phosphorus and potassium in abbreviating this period.

Hybrid strains of corn possessing adequate disease resistance to produce high quality grain and superior yields under low and average conditions of soil fertility and in unfavorable growing seasons were found to mature more rapidly after pollination, to produce longer and more slender ears with fewer rows, and to bear grains with a relatively higher content of horny starch. Long-season strains were more severely affected by plant-food deficiencies than the eariler maturing hybrids. In field tests, some hybrid strains outyielded native strains but produced seed susceptible to seedling disease.

Bacterial wilt was especially severe in sweet corn trials. Certain Golden Bantam hybrids suffered no damage under conditions which produced 11 per cent injury in the best commercial strains of this variety. Evergreen or Country Gentleman was unaffected. Certain of the hybrids possessed significant improvement in uniformity of maturity and in yield. A maximum yield increase of 100 per cent occurred in certain Golden Bantam strains. The spread of silk emergence was reduced from 20.5 days in commercial strains

to 11.5 days in hybrids. After 6 years of inbreeding, certain Golden Bantam strains remained as productive as the average commercial stocks.

Of 977 varieties of wheat, 415 of barley, and 120 of rye, studied for susceptibility to powdery mildew, 79 of those for wheat, 39 for barley, and 9 for rye were highly resistant. In barley 5 physiologic forms of powdery mildew were isolated. Mildew resistance was inherited as a simple dominant factor in most cases.

In clover, certain selections showed resistance to powdery mildew, and sulfur proved to be highly toxic to the fungus. Rust from alsike clover proved to be distinct from that on red clover. Clover plants possessing high resistance to anthracnose were discovered. The optimum temperature for anthracnose development was 28° C. (82.4° F.).

Bacterial canker was obtained on tomato plants imported from the South, but the disease was not found in Orange County fields. Dusting with copper-lime dust for the control of early blight and Septoria leaf spot increased the yields even with only 3 or 4 applications.

A method of obtaining tomato virus from the tissue of diseased plants is described. The suspensions lost their virulence upon passage through Livingston atmometer cups and certain filters and upon heating to 84 to 88°. Increasing the alkalinity of the suspension above pH 8.5 inactivated the virus, but it was restored upon acidifying. Upon electrolysis the virus passed to the positive pole.

Viruses were collected from healthy potato plants and from Jimson weed which will combine with the virus of tomato mosaic to produce tomato streak. When present alone in tomato, these viruses produced definite symptoms that ranged from a very mild to a very marked mottling with necrotic spotting and burning. Potato viruses were found in a wide range of hosts, including certain species that are not systemically infected by the tomato mosaic virus. The potato virus part of the streak virus complex may be recovered by inoculating Jimson weed, seedling potato, or a variety of eggplant, in which the tomato mosaic virus does not become systemic. The potato virus part of the streak virus complex is apparently not as easily transmitted by handling as is the tomato mosaic virus. Only one potato virus was found capable of combining with tomato mosaic virus to produce streak. Certain of the potato viruses withstood drying in diseased tissue for at least 16 days and withstood aging in juice of diseased tomato and Jimson weed for 60 days. One potato virus found in apparently healthy potato plants but never in true seedlings produced necrosis in certain seedlings, mottling in others, and no symptoms in others.

Tomato mosaic virus suspensions stored in a refrigerator without a preservative proved to be infectious after from 6 to 20 months. The H-ion concentration of the virus suspensions was usually about from pH 5.0 to 6.5 The virus was not inactivated when the acidity was increased to pH 2.46. When the alkalinity of the virus suspension was increased to about pH 7.5 to 8.5 a precipitate was formed and virulence was lost, to be regained when acidity was restored. Only some of the noninfectious juice prepared from mosaic plants produce fernleaf symptoms. Apparently the juice must first ferment in order to produce these symptoms, and juice from healthy plants did not produce fernleaf symptoms despite fermentation. The fernleaf principle could not be removed by precipitation with alcohol or acetone or by extraction with ether. Comparisons of chemical analyses of healthy, mosaic, and fernleaf tomato plants showed the infected plants to be higher in total nitrogen and lower in starch than the healthy plants.

[Plant pathology at the Iowa Station] (*Iowa Sta. Rpt. 1930, pp. 23, 24, 25, 26, 54, 55*).—Iacope, a yellows-resistant cabbage, developed 11 per cent yellows,

as compared with 17 per cent by Marion Market and 80 per cent by Copenhagen Market and Golden Acre.

Leaf spot of sugar beets, caused by the fungus *Cercospora beticola*, was less prevalent in 1929 than in 1928. Dusting with monohydrated copper sulfate and hydrated lime reduced the disease but did not give complete control. Certain cultural practices were also found to be beneficial.

Cedar-apple rust galls collected in Iowa, Kansas, Wisconsin, and West Virginia all produced heavy infections on Bechtel Flowering Crab but gave variable results on York Imperial and Tolman apples, suggesting the existence of physiologic strains. The West Virginia strain appeared particularly virulent.

Thirteen physiologic forms of oat rust were found differing greatly in prevalence, geographic distribution, and infective ability.

Ceresan treatment of barley seed infected with stripe disease increased the yields by from 15.2 to 18.7 per cent. Minsturdi and Oderbrucker were highly susceptible to stripe, and Trebi, Spartan, Nepal, and Black Hull-less were resistant. Ceresan was more beneficial on certain varieties than on others.

Watermelon wilt, a disease caused by a fungus living in the soil for several years, was combated by the development of resistant strains. One Kleckley strain, known as No. 73, showed 50 per cent resistance on a highly infected soil and 90 per cent on a mildly infected soil. One strain, having Conqueror as one parent, surpassed Kleckley No. 73 in resistance.

A new method for artificially infecting corn with *Ustilago zeae* was developed, based on reducing the surface tension of the solution used.

In studying the manner of infection of corn by Basisporium dry-rot, it was noted that active translocation within the plant seemed to be associated with resistance to infection except in the very late seedling stage, when there was often a depressive effect on growth by lowering the efficiency of the primary root system. Temperature through its effect on translocation was found to be an important factor in determining the amount of infection. The number of susceptible plants increased as translocation ceased either from normal or other causes. All the ears on plants in which translocation had ceased were not equally susceptible. Seed decay due to *B. gallarum* may be largely prevented by seed treatment if the critical soil temperatures do not persist more than four or five days after planting.

The yellow dwarf disease of the onion, caused by a virus that lives over in the sets and mother bulbs and is not soil or seed borne, was found to be controllable by discarding diseased sets and mother bulbs. Indexing the stock in the greenhouse gave a good reading on the health.

[Plant pathology at the North Carolina Station] (*North Carolina Sta. Rpt. 1930, pp. 97–110, figs. 4*).—Tobacco mosaic was found by S. G. Lehman to survive the curing process in barns. In the laboratory little or no inactivation of the virus was obtained in leaves thoroughly dried by gradually raising the temperature to 158° F. and holding it there for 47 hours. Even when held at 190.4° for 19 hours viability of the virus was not completely destroyed. The virus was found in the small rootlets of diseased plants as well as in the leaves, and also apparently in the soil near the roots. Mosaic survived for more than 4 months in soil which had been inoculated by adding juice pressed from fresh diseased leaves. A high percentage of young plants developed mosaic when inoculated with juice pressed from turgid roots collected in the spring from plants which had stood in the field. Mosaic was also developed by inoculating with the juice pressed from dead roots, but to a lesser degree. In successive plantings of tobacco, fall plowing is recommended to hasten the destruction of these roots. As compared with 4 per cent infection in new plantings on unplowed areas, less than 0.4 per cent was recorded where the stalks and roots were cut into the soil

in the fall, and less than 0.7 per cent where the stalks and roots were removed in the autumn or in the spring. A single crop of infested tobacco did not, therefore, seriously inoculate the soil.

The passage of the virus from the soil into the roots of tobacco is deemed to take place through wounds caused by insects or cultural tools. The percentages of mosaic developing in the field after 56 days were 4.9, 13.1, 78.8, 44.8, and 99.3, respectively, for (1) hands washed before pulling plants, (2) workmen chewing snuff and occasionally spitting on hands, (3) hands dipped into an infusion of diseased leaves, (4) same as (3) except plants dipped into limewater after pulling, and (5) plants dipped into an infusion of diseased leaves. Resetting in the exact spot from which mosaic plants had been removed greatly increased the percentage of infection. Cultural operations were observed to transfer infection from diseased to healthy plants. The white fly and flea beetle when moved from diseased to healthy plants did not transfer the disease.

A total of 34 seed treatments were tested on cotton and showed Ceresan and certain similar substances to increase materially the number of seedlings and to improve the uniformity of stand. In general, the results were such that 1.5 bu. of treated seed gave as good a stand as did 2 bu. of untreated seed. Delinted seed planted at Raleigh on April 16 gave a poorer stand than undelinted seed. However, when planted in May the results were opposite.

In respect to the control of oat smut, dry formaldehyde, Smuttox, Ceresan, and Corona Oat Dust gave very good control of loose smut and caused no marked seed injury.

In a study of *Bacterium pruni*, R. F. Poole obtained pure cultures from Abundance plum and peach cankers. So numerous were the cankers on the peach and plum that only extremely heavy pruning would remove them all. In respect to fruit infection, peaches borne on branches below, on the same level, and above cankers were equally infected. In many instances peaches on the same spur showed greater infection than others. The symptoms were variable on the fruit, ranging from a dry, corky, scab effect to watery spots with unbroken tissue. Leaf infection occurred about one month later than fruit infection. All commercial varieties were attacked, but with considerable difference in severity. Trees attacked by crown gall, root knot, or root rot seemed more resistant to bacteriosis than did healthy trees. Arsenical spray injury was actually no worse on diseased trees but appeared to be so. As to sprays, all copper compounds had to be discarded because of resulting defoliation. Both manganese sulfate and zinc sulfate caused serious injury to foliage when used without lime. Ferrous sulfate caused severe leaf spotting, but only slight defoliation. Calcium sulfate up to 20 lbs. to 50 gal. of water caused no injury. Heavy applications of colloidal sulfur, finishing lime, potassium permanganate, emulsified cresol, and emulsified phenol caused no injury, and in most cases reduced infection.

Tobacco and tomato wilts caused considerable injury, apparently as a result of high summer temperatures. Pure cultures of both organisms (*B. solanacearum* and *Fusarium lycopersici*) were grown in a sweetpotato decoction. Applications of zinc sulfate and lime, hydroxymercurichlorophenol, copper carbonate, Bordeaux mixture, colloidal sulfur, ground sulfur, and lime to the roots and stems of tobacco and tomato prior to planting in the field gave some benefit in certain cases, but none gave satisfactory control because of subsequent infection to new roots. Adjustment of the H-ion reaction of the soil to pH 4 and 5 reduced infection 75 per cent in an area where control plants were completely killed. Plants treated with sulfur and set in soils infected with *Thielavia basicola* indicated that a sufficiently high H-ion reaction was not obtained imme-

diately after transplanting to arrest the disease completely. The sulfured plants recovered and grew more rapidly.

In control experiments with *Leptosphaeria coniothyrium* on the dewberry, it was noted that cutting all canes below the soil materially reduced the disease but also reduced the formation of bearing canes. Where the pruning was made from 10 to 12 in. above the soil, the disease attacked the old canes. Diseased canes produced inferior fruit. It was evident that the organism is confined to the aboveground parts of the plant. The fungus begins its existence as a saprophyte on the spurs left after pruning and works slowly into the live tissues.

The dusting of ground sulfur on the roots and stems of diseased plants just before transplanting controlled the scurf disease (*Monilochaetes infuscans*) of the sweetpotato. The diseased tissues sloughed off, and both stem and potatoes were healthy at harvest. The sulfur apparently oxidized to sulfuric acid on the diseased parts, the acid killing the fungus. The reaction of pH 3 reached on some stems caused no damage. Yields were not affected by the sulfur treatment, but the percentage of diseased plants was greatly influenced. The disinfection of scurfed sweetpotatoes gave only partial control because the chemicals used could not sufficiently penetrate the periderm.

Copper compounds, including 20 per cent copper carbonate dust, copper acetate, and Bordeaux mixture were found highly effective in inhibiting infection by black rot (*Ceratostomella fimbriatum*). Formaldehyde gave promising results, but mercury compounds were not so beneficial. Inoculation studies conducted with the black rot organism showed that infection was very great following spore dissemination during harvest, and that development was rapid during the first few days after storage. Cross sections of sweetpotatoes placed in moist chambers at room temperature proved ideal growing media for black rot spores. Formaldehyde and copper compounds were found to be most effective in inhibiting black rot infection.

There was no difference in the infecting capacity of scurf, soft rot, black rot, and stem rot organisms grown on plant decoctions or on synthetic media. Definite relations were seen between the soil type and the prevalence of sweetpotato diseases. Indications were that the stem rot (*F. batatatis*) did not grow as well in heavy soils as in light sandy ones.

Among varieties, Triumph and Red Brazil displayed resistance to inoculations by *F. batatatis*, except between 27 and 30° C. These varieties were also more drought resistant than the others tested. Inoculation of sweetpotatoes with other fusaria found in the same location as *F. batatatis* gave negative results. The sweetpotato is apparently the only host to *M. infuscans* and *C. fimbriatum*.

Verticillium hadromycosis, B. A. Rudolph (*Hilgardia [California Sta.], 5 (1931), No. 9, pp. 197–360, pls. 4, figs. 9*).—Stating that hadromycosis, a plant disease specifically caused by the fungus *V. alboatrum* and related forms, causes considerable economic loss in California to a large number of widely unrelated plants, the author presents the results of a series of studies upon the nature of the disease and upon cross inoculations. According to a survey of the literature, more than 120 species included in 35 families and 18 orders are susceptible to this disease. Not only cultivated plants, such as the tomato, potato, raspberry, plum, and apricot, but also weeds, such as mallow, pigweed, bur clover, dandelion, and groundsel, were found susceptible, the weeds being a distinct menace as they undoubtedly helped to establish the disease in the soil.

The author discusses the life cycle of the disease and its effect on the plants both internally and externally. Tomatoes, potatoes, and other suscep-

tible truck plants are generally killed, while perennials, such as fruit and forest trees, may survive, depending on the severity of the attack.

Cross-inoculation experiments with pure cultures upon myrobalan seedlings, raspberries, and tomatoes proved the disease to be intercommunicable. The strain that attacks the tomato also readily attacks the apricot, suggesting the inadvisability of interplanting these two crops. Observations on 17 varieties of tomatoes revealed none possessing resistance worthy of note.

A thoroughgoing survey of the literature from 1879 up to and including 1928 is presented, with a view to aiding other workers.

The relative susceptibility of alfalfas to wilt and cold, G. L. Peltier and H. M. Tysdal (*Nebraska Sta. Research Bul. 52 (1930), pp. 15*).—A total of 50 introduced alfalfas and 22 domestic varieties were tested for susceptibility to *Aplanobacter insidiosum*, and a considerable portion of these was also tested for cold resistance. Marked differences were noted in susceptibility, but a few of Provence F. P. I. No. 34886, Hardistan, certain old and recent introductions from Turkestan, and possibly the Ladak variety were found resistant to both cold and wilt. Grimm, a certain number of other varieties, and all the domestic common alfalfas tested proved susceptible to wilt. Selections from the resistant Provence F. P. I. No. 34886 displayed greater resistance than did the plants from the original seed. It is considered likely that a search of old alfalfa fields in wilt-infested sections might yield other resistant forms.

Cantaloupe powdery mildew in the Imperial Valley, P. A. Miller and J. T. Barrett (*California Sta. Bul. 507 (1931), pp. 36, figs. 13*).—Losses approximating 15 per cent in 1925 and from 25 to 35 per cent in 1926 to the cantaloupe crop of the Imperial Valley were caused by powdery mildew and led to a series of studies on the nature and control of the disease, the results of which are herein reported.

Some evidence was obtained of the existence of biologic strains of the fungus. For example, repeated attempts to cross transfer the mildew from the sunflower to the cantaloupe failed, indicating that the powdery mildew fungus attacking the sunflower may be a distinct strain of *Erysiphe cichoracearum* incapable of harming cucurbits. This fungus, the etiology and symptoms of which are discussed in some detail, is believed to overwinter in the summer spore stage. Susceptible host plants grow in almost unbroken succession throughout the year.

Control experiments conducted from 1926 to 1929, inclusive, yielded no specific control but led to the recommendation that plant refuse of cucurbits and other susceptible plants should be plowed under as soon as the crops are harvested and that volunteer plants should be destroyed. Squash plants, a potent source of the disease, may be kept practically free from mildew by dusting with finely ground or sublimed sulfur. Sulfur dusts and sprays caused injury to cantaloupes, and dry copper dusts proved fungicidally inactive. Bordeaux mixture gave only partial control. The application of sulfur to the surface of the soil gave no positive results, and drilling sulfur or inorganic fertilizers into the soil was also of no distinct value. Too frequent or excessive irrigation should be avoided. Brush and paper windbreaks should be removed as soon as the crown set melons are well developed.

Cucumber disease investigations on Long Island, E. E. Clayton (*New York State Sta. Bul. 590 (1931), pp. 20, figs. 5*).—Suggesting that cucumber growing on Long Island had suffered largely because of diseases, chiefly mosaic but also wilt and mildew, the author discusses the nature and symptoms of these diseases and presents the results of experiments on their control.

Seed treatments were of no value in the control of any of the diseases but were beneficial in protecting early-sown seed. Of the materials tested, dusting with an organic mercury compound, Semesan Jr., gave the best results.

Cucumber beetles, carriers of the wilt organism, were fairly well controlled with dust mixtures, such as calcium arsenate-gypsum 1–15 and copper lime, with better results from sprays, among which Kayso-calcium arsenate 3–3–50 was the best, giving in addition to wilt control a beneficial effect on the plant. Bordeaux mixture as an early spray was inclined to cause stunting, although giving excellent wilt control.

Bordeaux mixture applied twice a week, beginning in late July, gave good control of mildew.

Mosaic did not yield to sprays or dusts, but some indication was obtained that mosaic-resistant strains could be developed. Inbreeding of the common varieties yielded strains possessing greater mosaic resistance than the parents. Progress was also made in developing wilt-resistant cucumbers. Certain introduced varieties of cucumbers possessed high resistance to mosaic and were used in the development of new types, combining resistance and desirable market qualities.

Investigations with oat varieties and diseases in the Upper Peninsula, B. R. Churchill (*Michigan Sta. Spec. Bul. 213 (1931), pp. 15, figs. 3*).—In respect to resistance to oat smut, the Markton variety was practically immune and Anthony highly susceptible, with Wolverine and Iogold ranging between. As seed disinfectants, formaldehyde, Smuttox, Ceresan, and copper carbonate were effective in the order given. Inoculation with spores increased the percentage of smut in Wolverine and Anthony oats. Seed treatments had no apparent effect on the yields of Wolverine and Iogold, but formaldehyde decreased the yield of Markton oats, while Smuttox and Ceresan increased the yield of the susceptible Anthony variety.

Stem rust, occurring in epidemic form once in every three or four years, was especially severe on the Silvermine, Markton, Wolverine, and Swedish Select varieties, with Richland and Iogold, early maturing varieties, little affected. The time of planting was found to be an important factor in yields, late planting of Iogold and Wolverine materially reducing the yield and the weight per bushel. Over a period of years, early maturing varieties proved most dependable.

Potato spraying and dusting experiments in Florida, 1924 to 1929, L. O. Gratz (*Florida Sta. Bul. 222 (1930), pp. 39, figs. 3*).—Presenting a general statement of the importance of controlling late blight, early blight, and hopperburn of the potato and a survey of the present status of control practices in the United States as a whole and in Florida in particular, the author discusses the results of experiments in Florida conducted over a period of six years, in which various sprays and dusts were compared and data obtained on costs, returns, etc.

Both spraying and dusting gave good results. Bordeaux mixture was at times significantly more effective than copper-lime dust in controlling early and late blight, but when equivalent amounts of metallic copper were applied the yield differences were not always demonstrated. Dusting cost more per acre than did spraying and was generally less successful, so that the net returns to the growers were considerably greater from spraying.

Three new wilt-resistant watermelons, I. E. Melhus, J. J. Wilson, and D. V. Layton (*Iowa Sta. Circ. 125 (1931), pp. 4, figs. 3*).—From many thousand selections and crosses, three new varieties, namely, Pride of Muscatine, Iowa King, and Iowa Belle, possessing decided resistance to wilt, are described, with information that seed is now available for distribution.

Apple scab spraying experiments in Tennessee, C. D. Sherbakoff and J. O. [illegible] (*Tennessee Sta. Circ. 37 (1931), pp. 4, fig. 1*).—Brief comments are

presented on the results of orchard experiments in the control of apple scab conducted with a view to determining the proper timing and number of applications. In wet seasons each of seven sprays applied contributed to the control of scab. The delayed-dormant, prepink, and pink sprays were apparently the most valuable, and in an exceptionally dry season, such as 1930, these three sprays gave very good control.

No material difference was noted whether lime sulfur was used throughout the season or whether Bordeaux mixture was substituted for lime sulfur toward the end of the period. Unless bitter rot is present, it is believed that lime sulfur will give satisfactory results, except when unusually high temperatures prevail.

Canker treatment for fire-blight control, J. A. McClintock and H. L. Fackler (*Tennessee Sta. Circ. 36 (1931), pp. 4, figs. 6*).—A general discussion of the fire blight situation, with special reference to the zinc chloride treatment of diseased tissues, which, though not found 100 per cent effective, gave satisfactory results on apple, pear, and quince trees in various orchards.

The treatment of lime-induced chlorosis with iron salts, J. P. Bennett (*California Sta. Circ. 321 (1931), pp. 12, fig. 1*).—Briefly discussing the nature and causes of lime-induced chlorosis appearing in fruit trees, bushes, and various ornamental trees, the author discusses several methods of control, namely, spraying, trenching, and injection of dry salts or solutions into the tree itself. Special reference is made to the last two methods, the practical workings of which are discussed in detail. It is emphasized that although the injection treatments have been highly successful and are widely used by growers, the practice gives only temporary relief, and permanent relief must be sought in soil treatments, the applications of which are still under investigation.

Some anatomical and physiological changes in Citrus produced by boron deficiency, A. R. C. Haas and L. J. Klotz (*Hilgardia [California Sta.], 5 (1931), No. 8, pp. 175–196, pls. 4, figs. 4*).—Observing a gradual reduction in the size of the shoots, sometimes resulting in the formation of multiple buds, of boron-deficient grapefruit and orange trees, the authors conclude that boron is obviously essential to cell division in the meristematic tissues and in the cambium. In the absence of sufficient boron the cambium and portions of the phloem were observed to disintegrate, and gum was formed, which found its way to the exterior through a split in the cortex. Xylem disintegration occurred in a smaller amount, if at all. Where growth had ceased and gum had formed as a result of a boron deficiency, recovery was brought about by supplying this element. The abnormal accumulation of carbohydrates in the leaves of boron-deficient plants is ascribed to the destruction of the phloem, with consequent interference with translocation. A reduction in the total sugar content of the leaves accompanied the restoration of vigor resulting from the addition of boron to the culture solution.

Citrus scab in Porto Rico [trans. title], M. T. Cook (*Porto Rico Dept. Agr. and Labor Sta. Circ. 92 (1931), Spanish ed., pp. 15, figs. 3*).—A general discussion of the nature of the disease, susceptibility of varieties, climatic conditions affecting the prevalence of the disease, and control methods and materials.

Chestnut blight in Michigan, D. V. Baxter and F. C. Strong (*Michigan Sta. Circ. 135 (1931), pp. 18, figs. 13*).—A general discussion of the chestnut blight situation, with special reference to Michigan, describing the symptoms and nature of the disease and pointing out the apparent hopelessness of saving the American chestnut. The possibility of breeding or isolating disease-resistant strains is discussed.

ECONOMIC ZOOLOGY—ENTOMOLOGY

Laws and regulations relating to game, land fur-bearing animals, and birds in Alaska, [1930–31 and 1931–32] (*U. S. Dept. Agr., Bur. Biol. Survey, Alaska Game Comn. Circs. 7 (1930), pp. 30, figs. 3; 8 (1931), pp. 34, pl. 1*).—These are the usual compilations of the laws and regulations, both Federal and Territorial (E. S. R., 61, p. 542).

The pharmacology of thallium and its use in rodent control, J. C. Munch and J. Silver (*U. S. Dept. Agr., Tech. Bul. 238 (1931), pp. 28*).—Following an introduction and a review of the literature on thallium, laboratory experiments, including feeding experiments and the methods adopted, physiological action on rats, and toxicity of thallium to rabbits by intravenous injection, are reported upon. Earlier accounts of this work by the senior author (E. S. R., 64, p. 264) and by Newsom et al. (E. S. R., 64, p. 264) have been noted.

A list is given of 148 references to the literature.

Wild-duck foods of North Dakota lakes, F. P. Metcalf (*U. S. Dept. Agr., Tech. Bul. 221 (1931), pp. 72, figs. 2*).—Following a brief introduction, the author deals with the important duck-food plants of North Dakota lakes and the tolerance of aquatic plants to concentrations of salts, discusses the classes of lakes surveyed, and presents an annotated list of plants collected about lakes and sloughs. A list of the common and scientific names of the plants mentioned is included.

Factors that influence the development and survival of the ova of an ascarid roundworm, Toxocara canis (Werner, 1782) Stiles, 1905, under field conditions, W. B. Owen (*Minnesota Sta. Tech. Bul. 71 (1930), pp. 25, figs. 5*).—The author finds the ova of *T. canis* to have survived the winter months under weather conditions obtaining in the region of Minneapolis, Minn., during 1927–28 and 1928–29.

"Observations during two consecutive winter seasons indicate that the surface soil temperature did not go low enough to kill the ova of this species, although air temperature was as low as −24° F. (−31.11° C.). The great contrast between air temperature and soil temperature during the winter season is accounted for by the abundance of snow, which acts as a blanket and keeps the surface soil relatively warm. Fur farmers can not rely upon having the soil temperature of animal pens in which snow is allowed to accumulate go low enough to kill the ova of this roundworm. Surface soil temperature of 131.9° F. (55.5° C.) were obtained in Kentucky and Minnesota on plats which had no protection from the sun. In cultures under these conditions, ova disintegrated before reaching the infective stage. Disintegration of ova was greater in sand than in humus soil both in part shade and complete shade during the summer in Minnesota. In Kentucky no apparent disintegration occurred in clay and sand soil with 42 days' exposure in complete shade during the latter part of July and the month of August.

"Laboratory tests indicate that, at a temperature of from 27° to 30° C., a relative humidity of 75 per cent is the lowest in which the ova of this species will complete development. It is not probable that ascarid ova can utilize atmospheric moisture before it is precipitated. Thus, retardation of development in air which is less than saturated with moisture is caused by loss of water from the ova. When this loss of water is great enough, death from desiccation results. Disintegration of ova in the soil from desiccation is the result of the combined effects of a series of interdependent physical factors of which soil type can not be excluded."

[Report of the department of entomology at the Indiana Station] (*Indiana Sta. Rpt. 1930, pp. 36–44, figs. 5*).—The results of work with the codling moth in 1928 and 1929 (E. S. R., 63, p. 548) are said to show the probable value and possible substitution of white oil sprays for arsenate of lead in the second and third brood cover sprays. In continuation of the studies with bands to trap the worms after they leave the apples, especial progress was made with chemically treated "self-working" bands to automatically kill them. In the 1929 studies bands treated with β-naphthol and α-naphthylamine gave best results, no emergence occurring from any of the bands so treated, with no apparent injury to trees, and they were about equally as efficient as the untreated bands in their attraction of the worms. The work of the year emphasized three points of great importance to the fruit grower who uses bands: (1) Four-in. bands are appreciably better than 2-in. ones, (2) corrugated paper with the smaller corrugations is noticeably more attractive to the worms, and (3) it is absolutely necessary to scrape all loose bark from trees if results are to be expected from the use of bands.

In referring to the work with the oriental fruit moth, it is stated that in southern Indiana there are five complete generations a year. In the absence of peach fruits the pest may go to apples and cause enormous losses to the crop, especially to apples in storage. Tests made with 14 repellent materials show no effect on infestation, and banding experiments indicated rather conclusively that banding as a means of control is impracticable and inefficient. Important information was obtained on the hibernation of the worms, which emphasized the importance of orchard sanitation as well as winter cultivation and paradichlorobenzene treatments. In natural control work 500 of the larval parasite *Macrocentrus ancylivora* were introduced in twigs from New Jersey in the spring of 1929, and in 1930 nearly 2,000 parasites were introduced in three orchards. Experiments at Vincennes indicate the possibility of a practical commercial control by the use of bait traps if used over a large area.

In work with the European corn borer (E. S. R., 65, p. 56), it was found in a study made of the planting date of corn at Auburn for the past 3 years that an average of 39 days was the time that should elapse between the planting date and the egg-laying peak to secure a crop of corn comparatively free from the European corn borer. It was found in a correlation between the stage in maturity and egg deposition on corn that among many of the varieties of corn studied the number of eggs laid on a given plant is directly proportional to the stage in maturity of the corn. A study of three common corn varieties in 1929 showed that corn plants averaged 15.78 in. high before they began to exert an attractive influence on the female moth for egg laying. There was an increase in the egg deposition on early planted corn as the height of the plants increased. In a series of experiments made with a view to determining the interval between egg laying and hatching, so that the length of time after hatching that the borers might be reached by insecticide applications could be determined, it was found that 3 days after hatching 85.3 per cent of the borers were still in an exposed position, end of 5 days 33.8 per cent, 8 days 15 per cent, 11 days 5.5 per cent, and at 14 days none was exposed. Tests in 1929 with 19 materials on 55 plats gave promising results, certain materials giving as high as 84.8 per cent control. In parasite control work a total of 110,703 individuals were liberated by the U. S. D. A. Bureau of Entomology from the commencement of the work in 1927 up to January 1, 1930. From January 1 to July 1, 1930, 52,238 individuals were liberated. The species *Masicera senilis* is said to have shown exceptional possibilities.

Brief mention is also made of work with vegetable and canning crop insects, miscellaneous insect problems, and rodent pests.

[Report of work in entomology at the Iowa Station] (*Iowa Sta. Rpt. 1930, pp. 25, 29–31, 56, 57*).—In continuation of the study of honey plants in Iowa (E. S. R., 64, p. 851), it was shown that yellow and white sweetclovers and white clover are the most dependable. Many ornamental plants, such as the Japanese barberry, European honeysuckle, Japanese honeysuckle, hollyhock, asters, Heliopsis, St. Johnswort, goldenrod, sunflowers, crane's-bill, and waterleaf, are, however, important honey plants. Comparative studies made of the sugar content and yield of nectar from more than 25 varieties of *Gladiolus primulinus* have shown that while it is not an important honey plant, nectar is produced in sufficient quantities to be easily obtained. The results indicate that only small characteristic differences occur in the percentage of sugar in the nectar of different varieties of a given species of gladiolus. The quantity of nectar yielded by the highest producing variety was three times that of the lowest.

In observations of June beetles from April to June in 1929 and 1930 at Ames, *Phyllophaga futilis* and an unknown species were the most abundant.

Investigations of the life history and habits of several of the stalk borers were continued (E. S. R., 64, p. 851). Particular attention was given in 1929 to the stalk borer, which is said to be by far the most important of the common stalk borers occurring in the State. A large series of experiments conducted to determine the effect of plant associations upon the borer population in a given locality showed that large weeds and grass growing together produce a maximum borer population and that the limiting of either the grass or the weeds reduced the population. Pure stands of either are little affected by the borer. One of the burrowing webworms (*Acrolophus* sp.) was found in 1930 doing considerable damage to corn on two farms in Story County.

In work at Ames with the onion maggots, Diamalt proved to be superior to molasses as an attrahent bait and supported the more extensive data secured in the field experiments at Pleasant Valley.

Brief notes are also given on insecticides, the apple maggot, and wheat insects.

Report of the section of entomology, R. H. Pettit (*Michigan Sta. Rpt. 1929, pp. 173–189, figs. 13*).—Accounts are given of the occurrence of and work of the year (E. S. R., 64, p. 239) with some of the more important insect pests, including cherry fruit fly service, oriental fruit moth, grape rootworm, raspberry fruit worm, shot-hole borer, white grubs (*Phytophaga* sp.), the strawberry root weevil (*Brachyrhinus ovatus*), a new cabbage flea beetle (*Phyllotreta aerea* Allard), oil sprays to control the onion maggot, termites (*Leucotermes flavipes*) in buildings, the two-lined prominent (*Heterocampa bilineata*), spruce mite (*Paratetranychus ununguis*), black cherry aphid, sprays to control codling moth injury, the potato stalk borer, and billbug attack on corn.

[Report of work in entomology in North Carolina], Z. P. Metcalf (*North Carolina Sta. Rpt. 1930, pp. 153–157*).—The projects under way briefly referred to include the biology of the Homoptera and the corn root worm, both by Metcalf; the corn ear worm and the Harlequin bug, a report on the latter having been noted (E. S. R., 63, p. 847), both by B. B. Fulton; wintering of bees and a survey of the honey-producing plants of the State, both by F. B. Meacham; the bees of North Carolina and the taxonomy and biology of the leaf-cutter bees, both by T. B. Mitchell; and the genetics of Habrobracon, by C. H. Bostian (noted on page 122).

In records kept of the corn root worm an average of 80 eggs per female was obtained from 192 females, one of which laid a total of 284. Oviposition took

place largely during the month of April. The eggs hatch in from 7 to 8 days on the average; the larval stage lasts from 20 to 50 days and the pupal stage from 8 to 9 days.

In observations of the corn ear worm the moths emerged within a month from nearly 70 per cent of the larvae placed in cages up to the middle of August.

In observations of 15 colonies of bees during 1928–29 the unprotected colonies made a very good showing, while with 10 colonies observed in 1929–30 the results favor the case packing method. In a survey of the honey-producing plants information on the blooming dates and honey production of about 35 different plants was obtained.

Oil sprays for dormant use, A. Spuler, F. L. Overley, and E. L. Green (*Washington Col. Sta. Bul. 247 (1931), pp. 27, figs. 10*).—Following a discussion of the general uses for oils in the dormant period in combating orchard pests (pp. 6–8), oil spray investigations are considered under the heading of viscosity, refinement, emulsification, and oil spray stimulation.

The experimental work conducted by the station for the past 7 years has shown that lubricating oil fractions are valuable in the control of San Jose scale, the fruit tree leaf roller, red spiders, tree hoppers, and aphids. "Oils ranging in viscosity from 100 to 220 seconds Saybolt have been found satisfactory for dormant use. Refinement of the oil beyond that of a grade known as red engine oil (unsulfonatable residue 50 per cent) is not necessary. Emulsifiers of the oil are not an important factor in insect control under field conditions. The size of the dispersed oil droplets and the stability of the oil emulsion produced by the emulsifiers influence the amount of oil that is deposited and retained on the plant. Fruit and leaf buds are susceptible to injury when sprayed with oil during the critical period of bud development. Injury to buds during the critical period of development is proportional to the amount of oil deposited on them. Quick-breaking emulsions deposit more oil on trees than stable emulsions and have to a corresponding degree produced more injury to plants. Miscible oil emulsions at 4 per cent strength did not generally injure trees even though applied during the critical period of bud development.

"If heavy applications of oils are necessary to control insects, these should be applied while trees are completely dormant. Over-spraying and spraying in windy weather should be avoided. Temperature seems to be a factor in so far as it delays the development of the buds during the critical period. Stayman and Winesap varieties have proved most susceptible to oil injury of all varieties tested."

The sources of American corn insects, C. R. Neiswander (*Ohio Sta. Bul. 473 (1931), pp. 98, figs. 3*).—In this contribution an attempt is made to classify the insects attacking corn according to their relationship with the corn plant and to demonstrate the sources, or the food material, from which they came to corn. This has been undertaken (1) by making field observations on the different crop successions terminating in the production of corn and recording the insects associated therewith, (2) by a study of the different plant forms attacked by the various insect species in order to ascertain if the so-called "botanical instinct" has developed sufficiently to cause them to select corn because it is closely related to their former native food plants, and (3) by a study of the literature as it applies to the derivation of American corn insects through the demonstration of an evolution in this direction. In order to make the known corn-insect fauna more or less complete as it applies to America, the author has included as a subordinate part the insects known to attack corn in storage.

The introductory part takes up the history of the corn plant and the origin of American corn-feeding insects—importation of foreign corn-feeding species and change of food habits in native species, followed by a conclusion, including natural ecological control and induced ecological control. The insects that attack corn in storage are then considered, (1) species associated with other injury in stored corn, (2) stored-corn insects that attack the ears of corn and fruits of other plants in field, (3) insects originally small grain feeders that now attack corn and other cereals in storage, and (4) insects that attack stored corn primarily. The classification of insects attacking corn as based upon their relationship to the corn plant and to other food plants or food, next presented, is followed by an annotated list of corn insects, arranged by orders and families. A bibliography of seven pages and an index are included.

Frankliniella fusca Hinds (thrips) on seedling cotton, C. O. EDDY and E. M. LIVINGSTONE (*South Carolina Sta. Bul. 271 (1931), pp. 23, figs. 4*).—This report of a biological study of *F. fusca* conducted at the station, principally in 1929, considers the life and seasonal history, injury, host plants, and control.

In the course of studies of the insect injury to seedling cotton in 1924 several species of thrips were found on the plants that were retarded and malformed in growth, *F. fusca* having occurred abundantly. Four forms of this species were found, namely, long-winged and short-winged males and long-winged and short-winged females, the long-winged male apparently being described for the first time. In the course of the studies unfertilized eggs were found to produce males and fertilized eggs females. A short-winged race was segregated by selection in the fifth generation and remained pure for that character during several following generations. In the studies to segregate the long-winged character, occasional short-winged forms occurred even in the seventh and eighth generations. In studies started in 1929 and 1930 both forms failed to produce progeny in December, 1929, and January, 1931, respectively.

"The incubation period for eggs averaged about 6 days, each of the larval instars 2 to 4 days, the prepupal and pupal stage 1 to 3 days. In tests females laid about 30 eggs during a period of 30 days, their total life being some 5 or 6 days longer than this. Males lived about 20 days less than the average for the females.

"Apparently *F. fusca* passes the winter as an adult female in and around the roots or base of host plants, such as crabgrass, broom sedge, and Bermuda grass, when or where weather is severe, and on oats, evening primrose rosettes, and other green plants in those places having mild winters. The above has been rather positively shown. No evidence has as yet been found that indicates that the males hibernate successfully. Observation showed that it is only necessary for females to pass the winter successfully in order to perpetuate the species. As many as two generations of *F. fusca* may be produced per month under favorable conditions. Under unfavorable conditions of development and with a maximum longevity of females, a generation may be present in the field during several months.

"Experiments showed that *F. fusca* malforms seedling plants and retards growth, that unfolding leaves contain holes and marginal erosions, and are distorted in shape. Grasses, cotton, and onions are principal hosts at Clemson College, tobacco being a major host in tobacco sections. Minor hosts include a wide variety of truck crops and certain field crops. Blossoms of certain plants also serve as hosts."

As an aid in control it is recommended that clean culture practices, such as the elimination of grasses and weeds in and around cotton fields at all periods

of the year, especially in the fall and spring, be followed. While this thrips may be controlled by the use of contact spray if applied frequently, no economical method of utilizing such sprays has as yet been worked out.

Further studies of truck crop aphids, G. E. GOULD (*Virginia Truck Sta. Bul. 71 (1930), pp. 809–835, fig. 1*).—This is a preliminary report of two phases of the study of aphids, the first dealing with host plants and the other with the overwintering habits of certain aphids and their possible use in control measures. The data presented are based on the observations of the author, supplemented by published work conducted at the station and elsewhere.

It is pointed out that there are present at one season or another 8 different species of aphids which cause injury to vegetable crops in Tidewater, Va., a table being presented as a means of identifying the 7 common species, namely, the green peach aphid, potato aphid, pea aphid, cabbage aphid, turnip aphid, melon aphid, and the bean aphid (*Aphis rumicis* L.). Descriptions are given of the adult forms of these species, together with notes on their life history, habits, economic importance, and means of control. Charts are given illustrating the seasonal host plants of the several species. These are followed by a list of 14 additional species that have been mentioned in the literature of this country, including descriptions of the adult forms of a red Macrosiphum on lettuce, followed by a general discussion of control, both natural and artificial.

A list of 49 references to the literature is included.

The biological control of mealybugs attacking citrus, H. S. SMITH and H. M. ARMITAGE (*California Sta. Bul. 509 (1931), pp. 74, figs. 21*).—This is a summary of information on the work conducted with mealybugs in California. The species considered include the citrophilus mealybug (*Pseudococcus gahani* Green), the citrus mealybug, the grape mealybug, the Japanese mealybug (*P. krauhniae* (Kuwana)), the long-tailed mealybug (*P. longispinus* (Targ.)), and the Mexican mealybug (*Phenacoccus gossypii* Towns. and Ckll.). The consideration of these mealybugs is followed by an account of their insect enemies, including the mealybug destroyer (*Cryptolaemus montrouzieri* Muls.), the Sicilian mealybug parasite (*Leptomastidea abnormis* (Gir.)), the brown lacewings (Sympherobiidae), the green lacewing (*Chrysopa californica* Coq.), and *Leucopis bella* Loew. Then follow a history of the development of biological control and accounts of mass production of Cryptolaemus, method of handling beetles, trunk banding as an aid to control, the relation of ants to mealybug control, effect of spraying and fumigation on biological control, buildings and equipment, and economics of the problem, and an appendix. A list is given of 15 references to the literature.

Macrocentrus gifuensis Ashmead, a polyembryonic braconid parasite in the European corn borer, H. L. PARKER (*U. S. Dept. Agr., Tech. Bul. 230 (1931), pp. 63, pl. 1, figs. 21*).—This is a report of work conducted at the European Parasite Laboratory of the U. S. D. A. Bureau of Entomology, at Hyères, Var, France, from April, 1927, to October, 1929. This braconid is a primary parasite of the European corn borer in France, Russia, and Japan, from which host in Artemisia, corn, and hemp it has been reared.

The eggs are laid in the body cavity of young host larvae during the latter part of June and early July, the development being by polyembryony, a method of development not before recorded in the Braconidae. In a study of polyembryonic development the author has demonstrated "(1) the differentiation of the egg into a pregerm composed of a paranucleus (probably derived from the polar nuclei) which directs and governs the trophamnios, and germinative or true embryonic cells which give rise to embryos; (2) the division by fission of the primary germ accompanied by a division of the paranucleus to form

the secondary germs, which again divide to form morulae, which demonstrate (3) polyembryony in *M. gifuensis*."

A summary of knowledge of the polyembryony among parasitic Hymenoptera is given in tabular form. A list is given of 32 references to the literature.

Tiphia popilliavora Rohwer, a parasite of the Japanese beetle, J. L. King and J. K. Holloway (*U. S. Dept. Agr. Circ. 145 (1930), pp. 12, pls. 4, figs. 2*).—A brief practical account of *T. popilliavora*, a wasplike parasite discovered in Japan in 1920, which has since been introduced from Japan, Chosen, China, and India, as part of the biological control work with the Japanese beetle. Following a brief introduction, the authors consider the distribution and strains of this parasite; its life history and habits, including seasonal occurrence, food plants, mating habits, egg laying, the egg, larva, and cocoon; difficulties in importation; early colonization and establishment; colonization in 1927, 1928, and 1929, including collection, colony distribution, and recovery.

It is pointed out that this larval parasite includes not only the Japanese form here considered but also a second physiological form occurring in Chosen and in China, which differs in seasonal appearance and in the fact that it parasitizes species of Popillia other than *P. japonica*, the Japanese beetle. Since its first successful introduction into three localities in New Jersey during 1921 to 1923, inclusive, the original colonies have spread, and in 1929 they were united over an area of 3.5 square miles. Artificial distribution from this center has been conducted since 1927, and up to 1929 releasements of 145 colonies had been made. It has been found that where 100 female Tiphia are liberated under favorable conditions, establishment is almost certain.

This species is considered well adapted for use in biological control, since it is a specific parasite of the Japanese beetle in its native land, and in this country this specific tendency is preserved. Comparisons have shown that the time of emergence and the period of adult activity and larval development are the same here as in Japan, indicating that the soil temperatures throughout the year are favorable for its normal development. The species frequents the flowers of wild carrot almost to the exclusion of other plants.

Since it is specific in its habits and is so perfectly adjusted to its new environment and has selected an abundant food plant, it is believed that it will prove to be one of the most important parasites acting in the biological control of the Japanese beetle.

An account of this species is included in Bulletin 1429 (E. S. R., 56, p. 860), and an account by King and Holloway has been noted (E. S. R., 63, p. 462).

[Report of apicultural studies of the Wyoming Station] (*Wyoming Sta. Rpt. 1930, pp. 23-25*).—Observations by C. H. Gilbert of the differences between Italian and Caucasian bees gathered in the experimental yards near Laramie are referred to. It was found that the Caucasians are more gentle under all conditions, build up more rapidly in the spring, and reach their peak earlier, that swarming propensity is in their favor, and that they fly in colder weather than do the Italians. The Italians were found to start brood rearing earlier in the spring, rear brood much later in the fall, and go into the winter with many empty combs in the brood nest, while the Caucasians cut down on brood rearing before the Italians (about 2 to 3 weeks) and fill the combs with honey for winter use. While the rate of oviposition during the entire season is practically the same, the Caucasians build up more rapidly in the spring and are ready for the honey flow. In the wintering of bees the Italians were found to consume 5.5 lbs. more honey per colony than the Caucasians in the period from September 17, 1929, to April 21, 1930.

ANIMAL PRODUCTION

[Animal nutrition studies at the Indiana Station] (*Indiana Sta. Rpt. 1930, pp. 63–65, 74, 75, fig. 1*).—The results of four studies, some of which have been continued (E. S. R., 63, p. 555), are reported.

Intensity of yellow color is a guide of vitamin A content of corn.—This study (E. S. R., 60, p. 810) was extended to determine the vitamin content of varieties of yellow corn possessing endosperm of varying degrees of color intensity. The vitamin A content of the varieties Woodburn, Reid Yellow Dent, and Clement was in descending order as named.

The effect of artificial drying on the vitamin A content of alfalfa.—The vitamin A content of artificially cured alfalfa hay was many times that of sun cured hay. Drying at a temperature of about 200° C. and drying rapidly at an extremely high temperature were equally effective for preserving the vitamin A content of alfalfa hay.

Mineral deficiencies of corn and soybeans.—As a supplement to a basal ration of corn, soybeans, casein, and yeast, mineral mixtures of limestone, superphosphate, and salt and limestone, steamed bone meal and salt gave better results than wood ashes, superphosphate, and salt for both hogs and rats. Limestone, rock phosphate, and salt proved to be a poor mineral supplement. Steamed bone meal produced the strongest bones, with superphosphate next, and rock phosphate produced the weakest bones.

Soybeans as a supplement to corn.—Adding either alfalfa leaf meal or soybean leaf meal to a corn and soybean ration improved its efficiency, and the supplementing effect was not due to the ash constituents of these meals. Using cooked or roasted soybeans in place of raw soybeans improved the rate of gains, and the feeding of ether and alcoholic extracts of the raw beans indicated that the beneficial effect of heating was largely due to the action on the ether soluble portion.

A study of chemical methods for evaluation of protein concentrates.—In this study with rats there were indications that the proteins of the hot water soluble fraction of tankages do not supplement the proteins of corn because of the lack of sufficient amounts of trytophane and possible cystine. However, this soluble fraction appears to supplement the combined proteins of corn and wheat bran.

[Animal nutrition studies of the North Carolina Station], J. O. Halverson (*North Carolina Sta. Rpt. 1930, pp. 86, 87, 88, 89*).—The results of two studies are noted.

Native forage plants of eastern North Carolina.—The results of chemical analyses of two native plants from the eastern swampy part of the State, reed grass (*Arundinaria tecta*) and sensitive joint vetch (*Aeschenomene virginica*), are given in tabular form. It was found that the upper portions of these plants had a good feeding value for grazing cattle.

Study of vitamin A in relation to feeding cottonseed meal and hulls in large amounts to cattle.—In cooperation with E. H. Hostetler, six steers were fed a ration of cottonseed meal, cottonseed hulls, beet pulp, and minerals. Three steers died as a result of feeding this ration, while two became sick, one of which was cured by feeding cod-liver oil and the other never fully recovered. The livers of all steers were fed to rats suffering with ophthalmia. It was found that when the steers were fed only the basal ration their livers contained no vitamin A, but where alfalfa hay or cod-liver oil had been fed vitamin A was present in the liver. Feeding cottonseed meal supplemented in various ways to rats showed that the meal was lacking in minerals and vitamin A.

[Beef cattle experiments at the Georgia Station] (*Georgia Sta. Rpt. 1930, p. 25*).—In this study with Angus steers, averaging 525 lbs. initial weight, there

were indications that peanuts and velvetbeans, both of which produce soft pork, do not have a similar effect upon the fat of beef animals. There were also indications that there is little difference in the refractive index numbers and in the melting points of beef fat produced from corn, velvetbean, or peanut feeding.

Roughages for fattening two-year-old steers, J. M. EVVARD, C. C. CULBERTSON, Q. W. WALLACE, and W. E. HAMMOND (*Iowa Sta. Bul. 253, abridged (1928), pp. 8*).—A popular edition of the bulletin previously noted (E. S. R., 60, p. 465).

Protein supplements and minerals for fattening yearling steers (*Iowa Sta. Rpt. 1930, p. 19*).—In a study with yearling steers averaging 658 lbs. per head and fed for 6 months on a basal ration of shelled corn, corn silage, alfalfa hay, and salt, it was found that linseed meal was more efficient for promoting gains and finish than cottonseed meal or a combination of cottonseed meal and linseed meal when fed without minerals. Adding minerals to linseed meal did not increase the rate of gain but did increase the finish attained, while adding minerals to cottonseed meal increased the rate and economy of gains.

Comparison of carbonaceous roughages, E. H. HOSTETLER ET AL. (*North Carolina Sta. Rpt. 1930, pp. 78, 79*).—Continuing this study at the Piedmont Substation (E. S. R., 63, p. 658), 2 groups of 15 steers each were fed for 114 days on a basal ration of equal parts of shelled corn and cottonseed meal. In addition lot 1 received cottonseed hulls and lot 2 corn stover. The average daily gains in the respective lots were 2.08 and 2.06 lbs. per head. In lot 1 it required 421 lbs. each of corn and cottonseed meal and 634 lbs. of hulls and in lot 2 452 lbs. each of corn and cottonseed meal and 524 lbs. of corn stover to produce 100 lbs. of gain.

[Beef cattle feeding at the Worland Substation] (*Wyoming Sta. Rpt. 1930, p. 43*).—Continuing this study (E. S. R., 63, p. 163) with 7 lots of 10 steers each, averaging approximately 1,100 lbs. per head, it was found that a ration of cottonseed cake, corn silage, and alfalfa produced gains of 2.65 lbs. per head daily. A ration of ground barley, beet pulp, and alfalfa produced an average daily gain of 2.68 lbs. per head. There was a difference of about 50 cts. in the cost per 100 lbs. of gain in favor of the barley lot. A comparison of corn silage and beet pulp showed that they produced about the same daily gain, but the cost per 100 lbs. of gain was about $1.10 in favor of the corn silage lot.

Steers fed long alfalfa gained somewhat faster and more economically than steers fed cut alfalfa when each was supplemented with wheat and beet pulp.

[Sheep studies in Indiana] (*Indiana Sta. Rpt. 1930, p. 20, fig. 1*).—Results of several experiments are noted, some of them continued (E. S. R., 63, p. 557).

Oats superior to corn for nursing ewes.—Lambs suckling ewes that were fed a ration of oats and clover hay or oats and timothy hay made more rapid gains than those suckling ewes fed corn and clover hay. Adding cottonseed meal to the oats and clover hay ration improved its efficiency for increasing the rate of gain on lambs.

Pasture as efficient as grain for suckling lambs.—In this test a lot of lambs was kept in an open shed, allowed to nurse twice daily, and fed grain and hay. Two other lots were on pasture with their dams, and one of these lots received grain in addition. The lambs receiving grass only made as rapid and more economical gains as either of the other lots and were as well finished at the end of the test.

Oats more valuable for lambs than for cattle.—For fattening lambs oats may replace all the corn in a ration containing cottonseed meal without reducing

the gains, but this is not the case with fattening cattle. However, substituting oats for part of the corn increased the efficiency of the ration in either case.

Grinding oats more necessary for cattle than for lambs.—Lambs fed whole oats made more rapid and economical gains than lambs fed ground oats, while the opposite was true with cattle. Finely ground oats were less efficient than whole oats for both types of animals.

Winter rations for the farm flock in eastern Oregon, R. WITHYCOMBE' F. M. EDWARDS, and E. L. POTTER (*Oregon Sta. Circ. 101 (1931), pp. 14, figs. 2*).—In concluding this study (E. S. R., 64, p. 369), it was shown that alfalfa hay alone was entirely satisfactory for wintering breeding ewes. Adding 1 lb. of either silage or grain to the alfalfa hay ration after lambing produced a slight but similar increase in the gains made by the lambs. The addition of 1 lb. of silage to the hay ration during the winter did not improve the ration, but did increase the wintering costs. Lambs from ewes fed silage were slightly larger at birth, but appeared to be less vigorous than those from ewes fed alfalfa hay only. The use of 2 or 3 lbs. of silage produced no better effects than 1 lb. There was apparently no difference in the value of pea and bald-barley silage, corn silage, and sunflower silage when fed with alfalfa hay for wintering breeding ewes.

A 100 per cent lamb crop at marketing time under the conditions of this test has paid the market price for feed, the labor, the interest on the livestock investment, and has taken care of death losses and replacements. It is possible in eastern Oregon with a good farm flock to produce what amounts to a 137 per cent lamb crop at marketing time.

[Experiments with sheep in North Carolina], E. H. HOSTETLER ET AL. (*North Carolina Sta. Rpt. 1930, pp. 79, 80, 81*).—Three studies are noted, two of which are in continuation of those previously reported (E. S. R., 63, p. 659).

Upgrading of native eastern North Carolina sheep.—The 6 native ewes in this experiment averaged 75 lbs. per head at lambing time, while 1 first-cross 2-year-old ewe weighed 121 lbs. The fleeces of the native ewes averaged 2.87 lbs. each and had an average staple length of 2.29 in. The corresponding figures for first-cross 2-year-old ewes were 6.83 lbs. and 3.42 in., and for first-cross yearling ewes 6.17 lbs. and 3.83 in. A comparison of the first-cross ewes with their dams showed that the use of a purebred ram increased the weight of the offspring 50 per cent, the weight of fleece 138 per cent, and the length of staple 49 per cent. There was also a marked improvement in the conformation of the animals and in the quality of fleece in the first-cross ewes.

Comparison of temporary pastures.—During a 30-day period 3 mature and 3 yearling ewes weighing approximately 108 lbs. per head made an average gain of 8.33 lbs. on Sudan grass pasture, while a similar lot on soybean pasture made an average gain of 20 lbs.

Cost of raising lambs to marketable age.—In this study at the Upper Coastal Plain Substation where sheep were made to utilize crop gleanings, cover crops, and pasture to the fullest extent, the average feed cost per head per year was $4.19 and the average return per ewe $5.37.

[Sheep studies in Wyoming] (*Wyoming Sta. Rpt. 1930, pp. 21–23, 32, 33, 40, 41, 42, 43*).—Several studies, three continued (E. S. R., 63, p. 163), are noted.

The chemistry of forage plants.—Analyses of 17 samples of native hay led O. E. McCreary to conclude that the chemical composition of native hay is fairly uniform regardless of the species of grasses which go to make up the hay.

O. A. Beath divided 3 groups of mature ewes into lots of 12 head each. Lot 1 was placed with a range band with herder, while lots 2 and 3 were placed in fenced pastures of mixed range plants. Lots 1 and 3 received ⅛ lb. of cotton-

seed cake per head daily, and lot 2 received a like amount of corn. From January 6 to February 15, lot 1 lost 15 lbs., lot 2 gained 2 lbs., and lot 3 gained 5 lbs.

Based on 3 years' observations, Beath ranked the following range plants in order of their palatability during the winter grazing season: White sage, salt sage, shad scale, brown sage, bud sage, black sage, and dead grasses and sedges.

[*Sheep studies at the Eden Substation*].—In this test 5 lots of sheep, averaging 59 lbs. per head, were fed for 100 days as follows: Lot 1, barley and alfalfa; lot 2, barley and oats, equal parts, and alfalfa; lot 3, barley and oats 1:4, and alfalfa; lot 4, barley and pea and oat hay; and lot 5, barley and oats, equal parts, and sweetclover hay. The average daily gains in the respective lots were 0.29, 0.28, 0.19, 0.28, and 0.26 lb. per head. The grain requirements per 100 lbs. of gain were 260.6, 282.6, 210, 280.2, and 311.1, and the hay requirements were 961.3, 1,001, 1,299.6, 1,041.9, and 1,387.5 lbs. in the respective lots.

[*Sheep feeding at the Torrington Substation*].—A feeding test of 100 days' duration with 7 lots of 50 lambs each, averaging 59 lbs. per head, showed that a ration of cottonseed cake, wet pulp, barley, and alfalfa produced an average daily gain of 0.39 lb., while when barley was omitted the gain was 0.33 lb. per head. The latter ration cost 68 cts. more to produce 100 lbs. of gain than the former. A ration of cottonseed cake, dry pulp, barley, and alfalfa cost more per unit of gain produced than either of the above rations. When barley was omitted only 80 per cent of the lambs were fat, while 96 per cent were fat when barley was fed. Barley-fed lambs gained somewhat slower, but at a less cost per unit of gain than corn-fed lambs. On the other hand, 96 per cent of the corn-fed lambs were fat and only 90 per cent of the barley-fed lambs were ready for market.

[*Sheep feeding at the Worland Substation*].—In this test 10 lots of 40 lambs each, averaging 73 lbs. per head, were fed for 100 days. A ration of barley, cottonseed cake, wet pulp, and alfalfa produced an average daily gain of 0.33 lb., but when the cottonseed cake was omitted the gain was reduced to 0.31 lb. per head. The use of 71 lbs. of cottonseed cake to produce 100 lbs. of gain increased the cost 55 cts. and also increased the degree of finish 3 per cent. A ration of barley and beans 3:1 and alfalfa and one of barley and alfalfa produced an average daily gain of 0.23 lb. per head. The feed cost per unit of gain was greater when beans were fed, due to the greater consumption of alfalfa. A comparison of long alfalfa and cut alfalfa showed that the cost of cutting was greater than the value of the increased gains produced by the cut hay.

[**Experiments with swine in Georgia**] (*Georgia Sta. Rpt. 1930, pp. 21–24*).—The results of three experiments are noted.

Velvetbean feeding tests.—Continuing this study (E. S. R., 63, p. 165), 5 lots of 10 pigs each were fed the following rations: Lot 1, ground corn, tankage, and minerals; lot 2, equal parts of ground corn and ground velvetbeans, tankage, and minerals; lot 3, ground velvetbeans, tankage, and minerals; lot 4, ground velvetbeans and minerals; and lot 5, ground velvetbeans, cooked, and minerals. All feeds were self-fed free choice. The average daily gains in the respective lots were 1.55, 1.07, 0.61, 0.09, and 0.21 lb. per head. The grain consumption per 100 lbs. of gain was 367.2, 400.4, 429.5, 1,980.1, and 1,002.3 lbs.; the tankage consumption, 39.1, 87.4, and 194.6 lbs.; and the mineral consumption, 1.09, 1.02, 4.97, 51.36, and 20.53 lbs. in the respective lots. Analyses of fat samples indicated that the increased softness of velvetbean-fed pigs was due to an increase in the percentage of unsaturated fatty acids, and to an increase in the unsaturation in these acids which was caused by an increase in the linolic acid content of the fat.

Hardening soft pork.—In this test 20 pigs, averaging 65 lbs. each, were used. Two animals were killed at the beginning to determine the nature of the fat at that time, and the remainder were fed for 8 weeks on a ration of peanuts, protein supplement, and minerals. At this time they were divided into two lots of 9 head each, averaging about 130 lbs. per head. One lot was self-fed free choice on shelled corn and protein-mineral supplement, while the other lot received sweetpotatoes and a protein-mineral supplement self-fed free choice with the addition of a limited amount of shelled corn. During the 10-week feeding period the corn-fed pigs made an average daily gain of 1.74 lbs. per head and those fed sweetpotatoes 1.32 lbs. When slaughtered, it was found that every animal in both lots was hard with no apparent difference between the lots, except that the kidney fat of the sweetpotato-fed hogs was considerably harder than that of the corn-fed hogs. The refractive index numbers for kidney fat were 1.4579 and 1.4591 and for back fat 1.4595 and 1.4592 for the sweetpotato and corn-fed hogs, respectively.

Swine parasite studies.—In cooperation with the zoological division of the U. S. D. A. Bureau of Animal Industry, 20 pigs were studied to determine the amount of infestation with internal parasites and the results of certain anthelmintics on the parasites. The livers of 11 pigs were normal, while 9 were parasitized. Fifteen head had kidneys free from kidney worms, while 5 had these parasites in the kidneys or the surrounding fat. Roundworms were present, but not in large numbers, and a few whipworms were identified, while nodular worms were common. Carbon tetrachloride, tetrachlorethylene, oil of chenopodium, santonin, and kamala were used as anthelmintics, but none was particularly effective with pigs 8 months or more of age. Sanitation appeared to be the most practical means for controlling internal parasites of swine.

[**Swine studies in Indiana**] (*Indiana Sta. Rpt. 1930, pp. 19, 20, 21, 22, 75, fig. 1*).—Most of the studies noted are continuations of those previously reported (E. S. R., 63, p. 558).

Mixture of protein concentrates better than tankage.—Mixed protein concentrates produced more rapid and economical gains for fattening hogs fed corn on clover pasture than meat and bone scraps. Soybean oil meal or cottonseed meal added to the meat and bone scraps was superior to the animal protein fed alone, while the addition of either linseed meal, dried kelp, or mineral mixture did not increase the value of this supplement.

Protein contents of tankage not true index of feeding value.—Tankages of different percentages of protein showed little difference in feeding value as supplements to corn for fattening hogs on clover pasture. Processed garbage, while inferior to tankage for producing rapid gains, was an economical feed.

Corn, oats, and tankage suitable ration for brood sows.—For brood sows the addition of kelp or a mineral mixture to a ration of corn, oats, and tankage did not increase the efficiency of the ration as measured by the weight, strength, and vigor of the pigs produced, nor did the addition improve a ration of corn, shorts, and tankage for suckling pigs.

Pigs need the out of doors.—There were more anemia and indications of stunted growth among pigs confined in a farrowing house for 4 weeks than among those removed to the outdoors before they were 1 week old.

Swine efficiency test completed.—In completing this study, it was found that a measure of the depth of the back fat and the length from aitch bone to first rib gave a fairly accurate indication of the yield of wholesale cuts. A covering of firm fat thin enough to permit high yields of lean cuts produced a desirable carcass.

Shrinkage in hogs being marketed influenced by many factors.—Such factors as feed supply, temperature, fill, distance from market, size of hogs, and season of year influenced the loss in weight in marketing hogs.

Anemia in swine.—Analyses of 64 samples of pigs' livers indicated that there was a prenatal storage of copper, iron, and manganese in the liver, which reserve decreased as the pigs grew older. The decrease in iron was about the same for the normal and anemic pig, but the decrease in copper and manganese was more marked in the anemic pig.

[**Swine studies in Iowa**] (*Iowa Sta. Rpt. 1930, pp. 16–19, 52, 53*).—The results of several experiments, some of which have been continued (E. S. R., 64, p. 865), are noted.

Modifications of the "Big Ten" supplement for fattening spring pigs in dry lot.—A basal ration of shelled corn and minerals was self-fed to 8 lots of pigs in dry lot. The Big Ten supplement was fed to lot 1, and the following amounts of other supplements were substituted for like amounts of Big Ten in the respective lots: 10 parts of soybean oil meal, 10 parts of corn gluten meal, 10 parts of coconut oil meal, 10 parts of wheat middlings, 5 parts of wheat bran, 10 parts of ground oat groats, and 5 parts of cane molasses. The ground oat groats proved to be the best single feed, producing an average daily gain of 1.57 lbs. per pig, requiring 414 lbs. of feed to produce 100 lbs. of gain, and returning a margin of $1.60 per head. Molasses was the second best addition, and while it had no effect on the rate of gain, it did decrease the feed required and cost of gains. Soybean oil meal also reduced the feed required per unit of gain. Adding coconut oil meal resulted in practically the same feed requirements and margin, but reduced the rate of gain as compared with the straight Big Ten supplement. The addition of wheat middlings or wheat bran had little effect on cost of gains or margin. The gains made when corn gluten meal was included were practically the same as when Big Ten was fed, but the margin per head was materially reduced.

Fish meals, tankage, and supplemental mixtures for fattening spring pigs.—In this test 15 lots of pigs were fed from weaning to an average weight of 225 lbs. on a basal ration of shelled corn and salt, self-fed. In addition fish meals, tankage, and several supplemental mixtures were self-fed as additions to the basal ration. Lots 1 to 11, inclusive, were fed on rape pasture and the others in dry lot. Tankage improved the corn ration on rape pasture, but in dry lot was excelled by both the Trinity and Big Ten mixtures, and in one test the Big Ten was superior to tankage on pasture. Fish meals prepared from haddock, menhaden, and herring were superior to tankage in profits per pig on the basis of feed prices charged in this study. Fish meals high in bone and relatively low in protein gave better results when fed with vegetable proteins than when fed alone as supplements to corn. White fish meal did not produce as satisfactory results as tankage. Cod-liver meal was quite palatable but, due to its high price, its use as a sole supplement was not economical. As an addition to suitable supplemental blends it was quite useful.

On a ration of corn and Big Ten mixture in dry lot, 48-lb. pigs required 110 days to reach 225 lbs. in weight, while pigs receiving the same ration on pasture required 126 days to reach this weight. Pigs receiving corn and Atco fish meal on rape pasture required 110 days to reach 225 lbs. in weight. The rape pasture effected little, if any, saving in corn, but did reduce the supplement requirements per unit of gain. The margins per pig were greater for pasture feeding than for dry-lot feeding.

Fish meals, meat meal tankage, and fish meal modifications of Trinity and "Big Ten" mixtures for fattening spring pigs in dry lot.—A basal ration of

shelled corn and minerals was self-fed in dry lot to 15 lots of pigs from weaning time to 225 lbs. in weight. In this test, menhaden, haddock, and white fish meals produced faster and more economical gains than did tankage, and of the three fish meals the white fish meal was the least efficient. The complete substitution of each one of the three fish meals for the tankage in the Trinity mixture increased the rate and the economy of gains and the margin per pig. However, when substituted for tankage in the Big Ten mixture, the beneficial effects were not so marked, although the menhaden and haddock meals did lower the cost and increase the margin slightly. The combination of fish meal and tankage was more efficient than either alone, and when such a combination was incorporated in the Big Ten mixture the rate and economy of gain and the return per pig were increased.

Swine performance record.—The average daily gains of spring pigs from 13 litters in this study ranged from 1.13 to 1.49 lbs. per pig, while the range for fall pigs from 14 litters was from 1.13 to 1.62 lbs. per head. The feed required per 100 lbs. of gain ranged from 359 to 421 lbs. for spring pigs and from 363 to 438 lbs. for fall pigs.

[Swine studies in Michigan], G. A. Brown (*Michigan Sta. Rpt. 1929, pp. 147, 148*).—Concluding the comparison of alfalfa and rape pasture (E. S. R., 64, p. 255) for spring pigs, it was found that there was little difference in the rate of gain or amount of corn consumed per unit of gain on either pasture. However, the pigs on rape consumed 40 per cent more protein supplement than those on alfalfa pasture. A group of pigs fed in dry lot gained as rapidly as those on pasture, but required a larger amount of grain and a considerably larger amount of protein supplement to produce a unit of gain than pigs on alfalfa pasture.

Cull navy beans were not efficient as the sole supplement to corn or barley for growing fattening pigs. Adding a small amount of tankage increased the rate and economy of gains. No appreciable differences were found in the firmness of carcasses of lots fed varying proportions of cull beans.

[Experiments with swine in North Carolina], E. H. Hostetler et al. (*North Carolina Sta. Rpt. 1930, pp. 81–85, 87, 88, 89, 90*).—The results of studies in continuation of those previously noted (E. S. R., 63, p. 661) are reported.

Mineral supplements.—Pigs having an average initial weight of 132 lbs. per head were divided into 4 lots of 11 head each and fed a basal ration of shelled corn and fish meal. In addition the respective lots received the following mineral supplements: None; ground limestone (dolomitic in lot 2 and calcitic in lot 3), superphosphate, and salt; and a commercial mineral mixture. The average daily gains in the respective lots were 1.68, 1.63, 1.6, and 1.53 lbs. per head, and the feed required to produce 100 lbs. of gain was 377, 399, 428, and 427 lbs.

Two groups of sows were fed the same grain mixture and in addition lot 1 received a mineral mixture of calcitic limestone, superphosphate, and salt, and lot 2 a commercial mineral mixture. In lot 1 an average of 9.8 pigs per litter was farrowed at an average birth weight of 2.3 lbs., and 5.6 pigs per litter were weaned at an average weight of 29.2 lbs. In lot 2 an average of 9.7 pigs was farrowed per litter, and 7 were raised with an average birth weight of 2.5 lbs. and an average weaning weight of 28.9 lbs.

Cottonseed meal for fattening pigs.—A basal ration of shelled corn and mineral mixture was self-fed to 2 lots of 11 pigs each for 78 days at the Swine Research Farm. In addition lot 1 received fish meal and lot 2 cottonseed meal and fish meal 2 : 1. In lot 1 the pigs made an average daily gain of 1.87 lbs. per head and required 408 lbs. of feed per 100 lbs. of gain, while in lot 2 the

pigs gained at the rate of 1.66 lbs. per head daily and required 401 lbs. of feed per 100 lbs. of gain. The lower cost of the protein supplement in lot 2 made this the most profitable lot.

Comparison of protein supplements.—At the Blackland Substation pigs originally averaging 82 lbs. per head and fed for 69 days on a ration of corn and fish meal weighed 208 lbs. per head, while those fed corn and a mixture of soybean oil meal, fish meal, and cottonseed meal, equal parts, averaged 218 lbs. per head. In a second trial, pigs averaging 96 lbs. per head and fed for 68 days averaged 219 lbs. when fed fish meal and 231 lbs. when they received the mixed protein. On the basis of the two studies, it was found that the pigs on the mixed protein supplement made 9.15 per cent greater gains at a cost of 3.12 per cent less per unit of gain than those receiving fish meal only.

Quantity of salt for curing meat.—In this test in cooperation with M. E. Thomas, 3 lots of 12 pieces of meat each were placed in a "cure" made up of 3 lbs. of brown sugar and 3 oz. of saltpeter per 100 lbs. of meat, to which was added 8, 12, and 16 lbs. of salt in the respective lots. One half the pieces in each lot were left in the cure 3 days per pound and the other half 4 days per pound. The results obtained by the judging committee and the chemical analyses showed that the pieces left in the cure the greatest length of time and those cured with the larger amounts of salt were the most salty when prepared for the table. In some cases the bacon with the most salt was preferred, but in all cases the hams and shoulders with the lesser amounts of salt were preferable. The pieces cured 3 days per pound had an average salt content of 5.16 per cent and those cured 4 days 6.32 per cent. The pieces cured with the varying amounts of salt contained 5.22, 5.84, and 6.28 per cent of salt, respectively.

A study of utilization of crops.—At the Upper Coastal Plain Substation, two 1-acre plats of soybeans, which had received the same kind and amount of fertilizer except that 80 per cent of the fertilizing constituents of the feeds fed the previous year were deducted from the amount of fertilizer applied to the second plat, were used in this study. A lot of 6 pigs averaging 70 lbs. each was turned on plat 1 for 98 days and fed in addition a 2 per cent ration of shelled corn and self-fed fish meal and mineral. These pigs gained at the rate of 0.85 lb. per head daily and ate 321 lbs. of concentrates per 100 lbs. of gain. After the soybeans were harvested both plats were seeded to rye, and from February 14 to April 1 a sow and her 4 pigs on the rye in plat 1 gained 160 lbs. and ate 549 lbs. of corn, fish meal, and minerals. A sow and 4 pigs on plat 2 during the same period gained 147 lbs. and consumed 572 lbs. of concentrates.

Value of permanent pasture for fattening pigs.—At the Swine Research Farm 3 lots of 15 pigs each, averaging 54 lbs. per head, were fed a ration of corn meal, wheat shorts, fish meal, and minerals. Lot 1 was kept in dry lot and lots 2 and 3 on 0.5 acre of orchard grass pasture each. The protein portion of the ration in lot 3 was half that fed in lot 2. The pigs on the respective lots required 96, 91, and 96 days to reach an average final weight of 200 lbs. The average daily gains in the respective lots were 1.55, 1.61, and 1.55 lbs. per head, and the feed requirement per 100 lbs. of gain was 354, 348, and 369 lbs. It was estimated that the pigs in lot 2 consumed 1,911 lbs. of grass and those in lot 3, 1,895 lbs.

Soft pork.—In cooperation with J. O. Halverson at the Swine Research Farm, it was found that the carcasses of pigs fed cottonseed meal following peanuts were not very satisfactory, since 11 of 52 carcasses graded physically either soft or medium soft. However, the analyses of the back fats indicated

that all carcasses were hard or medium hard. There was no consistent difference in the palatability of hams from representative carcasses.

Study of factors causing lameness and disease among swine at the Blackland Branch Station, Wenona.—In a cooperative test by Halverson and Hostetler, pigs weaned and fed feeds from this substation went off feed, developed lameness, and 3 of 7 pigs died. The livers of these pigs were found to contain no vitamin A when fed to rats on a vitamin A deficient diet. The addition of cod-liver oil or yellow corn to the ration improved the vitamin A content of the livers of the remaining pigs.

Swine feeding experiments, W. L. Robison (*Ohio Sta. Spec. Circ. 32 [1931], pp. 15*).—The studies reported in this publication are more detailed accounts of work previously noted (E. S. R., 64, p. 661).

[Swine studies in Wyoming] (*Wyoming Sta. Rpt. 1930, pp. 19, 20, 35, 37*).—Three studies, two continued (E. S. R., 63, p. 165), are noted.

Wyoming small grains for pork production.—Pigs averaging from 155 to 165 lbs. initial weight made average daily gains during a 60-day period of 1.48, 1.47, 1.28, and 1.4 lbs. per head when fed the following grains supplemented with tankage and minerals: Corn, ground barley, ground rye, and a mixture of equal parts of ground barley and ground rye. The grain requirements per 100 lbs. of gain were 390, 393.7, 423.9, and 394.3 lbs., and the tankage requirements were 40.8, 40.1, 43.8, and 40.3 lbs. in the respective lots. S. S. Wheeler found that the carcasses of the corn-fed hogs were noticeably, but not markedly, superior in firmness of finish and showed a somewhat better deposition of internal and external fat than the other lots. The corn-fed carcasses graded an average of 90.16 per cent, those of the barley-fed pigs 85.3 per cent, and those of the rye-fed pigs 82.9 per cent. There was little difference in firmness between the barley- and rye-fed carcasses. In dressing percentage the barley-fed pigs were slightly superior to the corn-fed pigs.

In a similar test with pigs averaging 111 lbs. initial weight, average daily gains of 1.23, 1.41, 0.78, and 1.28 lbs. per head were made during a 71-day period in the respective lots.

[*Swine feeding at the Gillette Substation.*]—In this test 4 lots of 8 pigs each were self-fed a Trinity mixture and minerals, together with corn, ground wheat, ground barley, and ground spelt for 80 days. The average daily gains in the respective lots were 2.16, 1.97, 1.74, and 1.59 lbs. per head, and it required 390 lbs. of corn, 423 lbs. of wheat, 441 lbs. of barley, and 440 lbs. of spelt to produce 100 lbs. of gain.

[*Swine feeding at the Lyman Substation.*]—A basal ration of tankage, minerals, and alfalfa was fed to 2 lots of 9 pigs each, averaging 70 lbs. per head, during an 80-day period. In addition lot 1 received barley and lot 2 wheat. The average daily gains were 1.75 and 2 lbs. per head in the respective lots, and it required 383 lbs. of barley and 357 lbs. of wheat to produce 100 lbs. of gain.

Preparation of feeds and the value of minerals in raising draft colts (*Iowa Sta. Rpt. 1930, pp. 19, 20*).—Two lots of four weanling colts each were fed a ration of oats, wheat bran, mixed hay, salt, and a mineral mixture. The colts in lot 1 were fed rolled oats and those in lot 2 whole oats. After 63 days the rations were changed and the feeding continued for a similar period, though with a reduction in the grain ration, since it was thought that the colts were becoming too fat.

During the first period lot 1 made an average daily gain of 1.74 lbs. per head and lot 2 1.5 lbs. per head. Less hay and grain were required to produce 100 lbs. of gain in lot 1 than in lot 2. During the second period, when the

ration of lot 1 was changed to include whole oats, it made an average daily gain of 0.97 lb. per head, while lot 2 gained 1.44 lbs. per head daily. Rolled oats showed a decided advantage in feed required per unit of gain, although when whole oats were fed the daily ration cost less.

[Poultry studies in Indiana] (*Indiana Sta. Rpt. 1930, pp. 58–63*).—The results of several studies are noted, most of which have been continued (E. S. R., 63, p. 562).

Amount of meat scrap for corn and wheat by-products ration.—On a basal ration of corn and wheat by-products, Barred Plymouth Rock pullets over a period of 2 years laid an average of 119 eggs per bird when 8.8 per cent of meat scrap was added, 110 eggs when 10 per cent of meat scrap, and 114 eggs when 12 per cent of meat scrap was added.

Tankage inferior to meat scrap when ration was half corn.—In this study whole yellow corn was used as a scratch grain, and the mash was made up of equal parts of wheat bran and wheat middlings. When 10 per cent of meat scrap was added to the above ration, the average production over a 2-year period was 110±3.6 eggs per bird as compared with 85±3.7 eggs when 8.4 per cent of tankage was added. The addition of 12 per cent of meat scrap gave an average production of 114±3.3 eggs, while 10 per cent of tankage produced 89±3.8 eggs per bird.

Nothing gained from dried buttermilk in a laying ration with meat scrap.—Three tests of 10 months each have shown no marked increase in egg production when one-third of the meat scrap in a basal ration of whole corn and equal parts of wheat bran and middlings was replaced by a like amount of dried buttermilk.

Condensed buttermilk improves laying ration with meat scrap.—A grain ration of yellow corn and a mash of wheat bran, wheat middlings, and meat scrap 2 : 2 : 1 was fed to two lots of White Leghorn pullets having access to outside yards during the late fall, winter, and early spring for two 10-month tests. One lot was fed 0.25 lb. of condensed buttermilk for each 10 birds daily. The lot receiving the buttermilk produced an average of 124±3.7 eggs per bird, while the controls averaged 95±4.7 eggs per bird.

Dried skim milk equal to dried buttermilk for chicks.—Dried skim milk and dried buttermilk were found to be equal in feeding value for chicks during the first 8 weeks.

Electric lights fail to increase growth rate for chicks.—In several tests with chicks there was no significant increase in growth rate due to the extension of the feeding period by the use of electric lights.

Dry mash effective as wet mash for broiler gains.—In a number of tests involving 19 lots of 23 or more White Leghorn or Barred Plymouth Rock cockerels per lot, there was no significant difference in the amount of gain produced by feeding dry mash or wet mash rations to fattening broilers, either in batteries or small pens.

Protein requirements for growing pullets.—It was found that during the growing period, 8 to 22 weeks, the rate of growth of Barred Plymouth Rock pullets was closely associated with the amount of meat scrap fed, and that the amount of protein could be increased or decreased to accelerate or retard the growth and development of the pullets.

Feed consumption and growth rate of turkeys.—The feed consumption and growth rate of Bourbon Red Turkeys at different ages, covering a period of 4 years, are given in tabular form.

[Poultry studies in Iowa] (*Iowa Sta. Rpt. 1930, p. 22*).—The results of two studies are briefly noted.

Breeding for egg production.—White Leghorn and White Plymouth Rock birds were apparently homozygous to a high degree for early maturity. This pureness appeared to be closely related to high egg production.

Rations for growing chicks.—A mash mixture of yellow corn, dried buttermilk, bran, middlings, bone meal, and salt 50:15:15:15:4:1 produced satisfactory growth with chickens and turkeys, and also with ducks and geese when the bone meal content was increased to 10 per cent.

[Studies with poultry in North Carolina], R. S. Dearstyne (*North Carolina Sta. Rpt. 1930, pp. 139–143, figs. 2*).—The results of two studies are noted.

Cost of egg production with two flocks receiving a single source of animal feed and a double source.—In this study conducted at the Coastal Plain Substation, it was found that there was a tendency for birds to produce more eggs when fed animal protein from two sources. It required 0.2 lb. more feed to produce 1 doz. eggs in the lot receiving protein from a single animal source, but the feed cost per dozen eggs was 3.2 cts. higher in the lot receiving protein from two animal sources. The detailed results are given in tabular form.

Experiments in crate fattening.—A total of 838 birds were used in this study to compare the efficiency of two types of fattening rations for finishing broilers in crates (E. S. R., 63, p. 666).

The first ration consisted of corn meal, pulverized oats, and meat meal 40:40:20, and the second ration corn meal, pulverized oats, meat meal, and dried milk 38:38:10:14. The feed was mixed to a batter with water and fed three times daily. The birds were fed for from 8 to 11 days, with those in lot 1 making an average gain of 0.53 lb. per head and those in lot 2 0.555 lb. per head. Lot 1 consumed 3 lbs. less feed than lot 2. The cost per pound of gain was 11.6 cts. in lot 1 and 14.1 cts. in lot 2. The ration containing milk produced a better type of edible meat than the ration in which meat meal was used as the sole source of animal protein.

[Poultry studies in Wyoming] (*Wyoming Sta. Rpt. 1930, pp. 13–15, 36*).—The results of several studies, some continued (E. S. R., 63, p. 166), are noted.

Crooked breastbones of turkeys.—F. J. Kohn found that the shape of the breastbone could be controlled by the age at which green alfalfa and cod-liver oil feeding started. Birds properly fed did not develop crooked breastbones, even when they started roosting at a very early age.

How to protect poultry from cold.—In this test by Kohn, it was found that a poultry house with a straw loft and with sides insulated with straw could be kept comfortably warm without artificial heat, even during cold weather. White Leghorn pullets were kept in houses with a temperature range of from 15 to 20° F. without any bad effect on egg production, but temperatures as low as from 8 to 10° slowed up production as much as 25 per cent. Combs began to freeze at 6°, and the birds were thrown out of production when the houses went from 0 to −5°. Rhode Island Reds, Plymouth Rocks, and White Plymouth Rocks could stand temperatures from 5 to 10° lower than White Leghorns to produce the same effects.

A high relative humidity and warmth were not unfavorable to the maintenance of health, while high humidity and cold undermined health. Moisture and stale, stagnant air were more harmful than moisture and fresh air, but both conditions were undesirable. Cold, dry air was not injurious to either health or egg production. Combs froze more rapidly in cold, moist air than in cold, dry air.

Feeding poultry.—Kohn also found that replacing the corn in a laying mash with ground barley had no bad effects on egg production. Feeding whole grain from hoppers opened about 3 p. m. saved labor and appeared to have a beneficial effect in prolonging the production period as compared with feeding grain

in the litter. With cull potatoes valued at 0.5 ct., grain at 1.6 cts., and mash at 2.5 cts. per pound, the introduction of cooked cull potatoes to the ration of molting hens at the rate of 12 lbs. per 100 hens daily effected a saving of 8.6 cts. in feed cost. However, the cost of cooking and extra labor used all but 2 cts. of this margin. The hens fed this ration thrived well. On the other hand, adding cooked potatoes to the ration of laying pullets was not satisfactory because 4 lbs. per 100 birds was as much as could be fed without lowering egg production.

[*Poultry feeding at the Lyman Substation*].—The average production of White Leghorns receiving a ration in which corn composed 20 per cent of the mash and 50 per cent of the scratch feed was 194 eggs one year and 121 eggs the next. The average production when barley replaced the corn was 208 and 119 eggs, respectively.

DAIRY FARMING—DAIRYING

[**Dairy cattle studies in Indiana**] (*Indiana Sta. Rpt. 1930, pp. 28, 29, fig. 1*).—Most of these studies reported have been continued (E. S. R., 63, p. 566).

Intermediate v. late soybean hay for milk and fat production.—Soybean hay cut when about half of the lower leaves had fallen, the pods about three-fourths formed, and the beans fairly well developed was compared with hay cut when the pods had reached their full development and the beans well formed. The late-cut hay proved superior to the intermediate hay for both milk and fat production. The cows refused 4.85 per cent of the intermediate and 4.24 per cent of the late-cut hay. There was no significant difference in the effect of the two hays on body condition.

Supplementing Sudan grass pasture for milk and fat production.—The second test in this study showed that it was not economical to feed grain to cows on good average Sudan grass pasture.

Ground soybeans v. linseed meal as protein supplements for growing dairy heifers.—Two lots of four calves each were fed whole milk for 90 days and timothy hay for the first 60 days, replaced by alfalfa hay during the last 300 days of the test. In addition both lots received a ration of ground corn, ground oats, wheat bran, and either linseed meal or ground soybeans. The calves receiving linseed meal grew an average of 13.55 in. in height and made an average daily gain of 1.18 lbs. per head, while those receiving ground soybeans grew an average of 13.2 in. in height and gained 1.14 lbs. per head daily.

[**Dairy cattle studies in Iowa**] (*Iowa Sta. Rpt. 1930, pp. 20–22, 27, 28, 47*).—The results of several studies are noted.

Influence of water bowls on water consumption and milk and fat yields.—In a test with 2 lots of 5 cows each which during alternate 5-week periods were watered either from drinking cups in the stalls or twice daily at outside tanks, it was found that the cows with drinking cups consumed 18.37 per cent more water and produced 6.14 per cent more milk and 12.12 per cent more fat than cows watered at outside tanks. Cows receiving water from drinking cups drank an average of 10.3 times per day, and 36.1 per cent of the water was consumed between 5 o'clock p. m. and 5 o'clock a. m. Cows using the drinking cups consumed 3.76 lbs. of water for each pound of milk produced, while those watered outside drank 3.26 lbs. of water for each pound of milk. Long spells of excessively cold weather had little or no effect on water consumption.

Factors other than age causing variations in live weight in dairy cows.—In a comparison of real average monthly weights and weights obtained by averaging 3 days' weights taken at different times of the month, the daily weights of 58 animals covering a period of 300 months were compared with the usual 3-day

weights of the station herd. In 62.3 per cent of the cases there was a variation of less than 1 per cent for weights taken on 3 consecutive days and less than 1 per cent variation in 76.5 per cent of the cases of 3-day scatter weights. There was no relationship between the size of the animal and the extent of the variation.

In a study of the weights of 144 animals covering 256 gestation and lactation periods, a regular marked increase in weight was found beginning about the third month of pregnancy. The increase was greater than the calculated weight of the fetus and was accompanied by a regular decrease in milk flow. For large cows the increase in body weight amounted to 14.6 per cent and for small cows 10 per cent. The loss in weight at parturition varied proportionately with the size of the cow. High-producing cows lost more weight and recovered that weight slower than low-producing cows, but the former animals recovered a higher percentage of their weight during the dry period than the low-producing cows.

Metabolism trials with young calves.—Calves varying in age from 23 to 256 days showed no significant differences in their coefficients of digestibility of the various nutrients in a ration made up of whole milk only. The younger calves stored larger percentages of calcium, phosphorus, and nitrogen of the milk than did the older calves. While milk was an ideal source of protein, calcium, and phosphorus for young calves, it was not an economical feed for older calves when fed alone since it did not contain enough carbohydrate material to meet the energy requirements of these animals. Adding cornstarch to a milk ration did not exert any appreciable protein sparing effect, nor did it adversely affect calcium and phosphorus storage, but did depress somewhat the digestion coefficients of protein and nitrogen-free extract. Oat straw and alfalfa hay added to the milk ration of 212- to 272-day-old calves depressed markedly the digestion coefficients of the proteins of the ration. Calves 4 months of age were apparently able to digest and utilize the nutrients, except crude fiber, of a grain and hay ration as well as older calves. The storage of calcium per kilogram of live weight by 4-months-old calves amounted to about 0.1 gm. regardless of the ration fed.

Some possible factors in the etiology of sterility in young heifers.—Biweekly determinations of the calcium and inorganic phosphorus content of the blood plasma were made on three lots of five heifers each. One lot was considered normal, the second lot was inclined toward sterility, while the third lot had been isolated as probable hosts of the Bang bacillus. There was little variation in the blood calcium of the lots. The inorganic phosphorus content of the blood plasma of lot 3 was distinctly lower than that of lot 1, while the results in lot 2 were intermediate.

[Studies with dairy cattle in North Carolina], R. H. Ruffner and C. D. Grinnells (*North Carolina Sta. Rpt. 1930, pp. 91, 92, 96*).—Three studies are noted.

Dairy cattle pasture management studies, I.—This study, made in cooperation with P. H. Kime, showed that a plat grazed moderately during the pasture season appeared to be in better condition at the end of the pasture season than one heavily grazed. However, at the beginning of the next pasture season there was less difference in the two plats than there had appeared to be in the fall.

Corn silage.—During a 120-day feeding period, cows fed either corn or sorghum silage produced 18.1 lbs. of milk per head daily. However, the cows fed corn silage produced milk containing 3.95 per cent of butterfat, while the fat content of the milk produced on sorghum silage was 3.82 per cent.

The value of fly repellents in maintaining summer milk production.—There were no marked differences in the number of flies on sprayed and unsprayed cows while on pasture. In the barn the unsprayed cows were covered with approximately six times as many flies as the sprayed group. There was a slight increase in the milk production of the sprayed group.

[Dairy cattle studies at the Wyoming Station] (*Wyoming Sta. Rpt. 1930, pp. 16–18*).—The results of two studies are noted.

Native hay for milk production.—H. S. Willard found that feeding a high-protein grain ration containing 15 per cent of digestible protein with native hay to dairy cows produced no better results than when a low-protein grain mixture containing 11 per cent of digestible protein was fed. When fed at the rate of 8 lbs. of grain to 29.6 lbs. of hay per day, the feed cost of 100 lbs. of milk was the same with both grain mixtures. Increasing the grain ration increased production, and partially spoiled hay was made more palatable by the addition of molasses. Sunflower silage added variety and increased the palatability of the ration and also the milk production. A decided increase in milk production followed the turning of the cows on pasture.

The value of grain for dairy heifers.—Continuing this study (E. S. R., 60, p. 770), it was found that good high-producing Holstein heifers could be grown to maturity and go through a lactation period with good prodution without receiving grain. However, there were indications that from the standpoint of health and production during subsequent periods it was not a safe practice.

A comparison of tepary bean and cowpea hays in a dairy ration, E. E. Jacobs (*[Oklahoma] Panhandle Sta., Panhandle Bul. 26 (1931), pp. 3–8*).—In this test two lots of three cows each were fed the same basal ration during alternate 21-day periods. During the first period one group received tepary bean hay and the other group cowpea hay, while during the second period these hays were changed. Due to a shortage of tepary bean hay no time was allowed for the cows to become accustomed to their feed, nor was there any transition time between the feeding periods.

There was apparently no difference in the feeding value of tepary bean hay and cowpea hay for dairy cows. Because of the adaptability of tepary beans to localities where neither alfalfa nor clover can be successfully grown and because they produce larger quantities of digestible nutrients per acre than cowpeas, tepary bean hay can successfully replace cowpea hay in the ration for dairy cows.

[Dairying experiments in Indiana] (*Indiana Sta. Rpt. 1930, pp. 30–34, fig. 1*).—Some of the following studies have been previously noted (E. S. R., 63, p. 567).

Dairy marketing investigations.—The Four-Day Delivery Plan for marketing cream for butter making has resulted in an upward trend of premium cream sales. During the year 1930, 59.1 per cent of the butterfat marketed was premium as compared with 54.9 per cent for 1929 and 53.3 per cent for 1928. The average score of butter made from premium cream was 88.5 points, while that made from regular cream was 87.28 points.

Other studies indicate that the reduction of time between purchasing and churning may result in an increase of 0.8 point in the average score of premium cream butter and 0.36 point of regular cream butter, that the mechanical cooling of cream at the receiving station and proper cooling to creamery may prevent a depreciation of from 0.5 to 0.75 point in the score of the resulting butter, and that delivering cream at intervals of less than 4 days improves the quality of the cream and increases the score of the butter about 1 point.

The study of enzymes in sweet and sour farm-skimmed cream as related to the keeping qualities of butter.—In this study it was found that the activity of the proteolytic enzymes produced by *Streptococcus liquefaciens* was not as great as that produced by *Bacillus ichthyosmius*. The activity of the enzymes produced by *S. liquefaciens* extended through the pH range of 8 to 2, with the greatest activity at pH 2. The soluble nitrogen not precipitated by phosphotungstic acid after 15 days' incubation in gelatin containing from 0 to 20 per cent of salt was 1.05 per cent at pH 8, 1.2 per cent at pH 6, 1.4 per cent at pH 4, 1.59 per cent at pH 3, and 1.72 per cent at pH 2. While the proteolytic action of these enzymes was only slightly retarded by salt concentrations under 10 per cent, there was a distinct retardation by a 20 per cent concentration. The proteolytic action of two strains of these organisms was found to be alike.

The proteolytic enzymatic activity of all the strains of *S. lactis* studied was greatest at pH 4. These strains also showed a greater tryptic action than peptic, regardless of the range of acidity. When *Oidium lactis* was grown with *S. lactis*, there was a distinct increase in the proteolytic activity of the culture.

Physical, chemical, and bacteriological study of factors affecting body texture and quality of ice cream.—Only slight differences were found in the bacterial count of ice creams frozen soft, medium, and hard. *Escherichia coli* types of bacteria were found in 25 per cent of the mixes, while *Aero aerogenes* were found in 75 per cent of the mixes after pasteurization in concentrations of more than 100 per cubic centimeter.

A study of the methods used in washing and sterilizing of milking machines and their comparative value.—While chemical sterilizers of the chlorine group were satisfactory for keeping milking machines in good bacteriological condition, it was hard to keep the solutions up to strength in the rubber parts. When washed with hard water, a sandy granular precipitate was formed which was difficult to remove from the rubber, and at the proper strength a cracking of the rubber was caused. To overcome these difficulties sodium hydroxide was tried as a sterilizing agent, and it was found that when used in solution at pH 12.5, or a 0.3 per cent solution, satisfactory bacteriological results were obtained.

The value of mechanical refrigeration on the dairy farm.—The bacterial growth in milk during a 12 to 14 hour storage period was slight when the water in a cooling tank was maintained at from 35 to 45° F, but when the water was maintained at 55° the bacterial increase was nine times greater at the lower temperatures. Precooling milk over surface coolers gave lower bacterial counts than no precooling only when the cooler was carefully washed and sterilized. Stirring the milk for the first 15 minutes in the cooling tank showed a decided advantage only when the tank was maintained at 55°. The milk stored at 35° showed less bacterial growth during transit than milk stored at 45°.

Influence of air on cream deterioration.—A comparison of cream held in air-tight containers and cream exposed to air showed that the exclusion of air inhibited the bacterial growth in samples held 48 hours and also inhibited the growth of yeasts and molds in samples stored for 24 hours or longer. Protein hydrolysis was decreased and acidity increased in cream held 24 hours or longer in sealed containers.

Cooperative work with creameries (*Iowa Sta. Rpt. 1930, pp. 28, 29*).—Analyses of 232 butter samples submitted during the first month of this study showed that 36 per cent contained from 80 to 81 per cent of butterfat, 33 per cent contained from 81 to 82 per cent, 15 per cent contained from 82 to 85 per cent, and 16 per cent less than 80 per cent of butterfat. Analyses of samples from the same creameries 8 months later showed that 51 per cent of the samples contained from 80 to 81 per cent of fat, 24 per cent contained

from 81 to 82 per cent, 3 per cent contained over 82 per cent, and 22 per cent contained less than 80 per cent of butterfat.

Summary of dairy refrigeration studies, R. H. RUFFNER and C. D. GRINNELLS (*North Carolina Sta. Rpt. 1930, p. 96*).—This study, made in cooperation with W. L. Clevenger, showed that milk shipped 40 miles by rail gave an average bacterial count on arrival at the milk plant of 64,000 per cubic centimeter when ice was used. After the installation of mechanical refrigeration, the bacterial count dropped to 21,000 per cubic centimeter the first year, 14,000 per cubic centimeter the second year, and 17,700 per cubic centimeter the third year. Mechanical refrigeration reduced the labor of handling and cost, was more sanitary, and gave a lower temperature.

Fat losses in buttermilk, W. B. COMBS and S. T. COULTER (*Minnesota Sta. Bul. 273 (1930), pp. 30, figs. 12*).—Concluding this study (E. S. R., 60, p. 366), it was found that a modified Babcock test, termed the Minnesota test (E. S. R., 63, p. 506), gave a true measure of the fat content of buttermilk.

The average fat content of buttermilk at the experimental creamery was 0.28 per cent in 1929 as compared with an average test of 0.5 per cent in Minnesota creameries. Evidence is presented to show that centrifugal separation of fat from buttermilk is impractical, except in creameries producing 25,000 lbs. or more of sweet buttermilk daily. The coagulated casein of sour buttermilk clogs the separator bowl.

Factors affecting the fat losses in buttermilk were found to be the temperature of churning, time and temperature of holding cream previous to churning, and seasonal conditions. Holding cream overnight at the churning temperature or holding for from 2 to 4 hours at 32°+ F. previous to churning lowered fat losses as compared with losses which occurred when cream was churned immediately after cooling. Overloading the churn resulted in a slight increase in the fat content of the buttermilk.

Recommendations are presented for keeping the fat losses in buttermilk uniformly low.

Dry skimmilk in ice cream, W. V. PRICE and R. WHITAKER (*New York Cornell Sta. Bul. 516 (1931), pp. 37, figs. 8*).—Continuing this study (E. S. R., 60, p. 664), it was found that the proper dispersion of dry skim milk in the liquids of an ice cream mix was essential for attaining high quality. Sprinkling the mixed dry products on the cold liquids appeared to be the most practical means of obtaining the proper dispersion. Fresh whole milk as a source of water in the mix produced a higher-quality product than the use of either water or skim milk. Fresh cream was the most desirable source of fat in mixes using dry skim milk, but frozen cream and sweet butter were used with good results. The use of improvers in mixes containing dry skim milk did not alter either the flavor or texture of the ice cream.

Of the four types of dry skim milk, spray, flake, vacuum roll, and atmospheric roll, used in these tests, all made ice cream of satisfactory quality. However, the atmospheric-roll powder was relatively insoluble and imparted a cooked or custard-like flavor which was distinctly noticeable. This powder slightly impaired the whipping properties of a mix, but improved the texture of the ice cream slightly. A limited number of studies indicated that the quality and freezing properties of ice cream containing dry skim milk were equal to that of ice cream containing other concentrated milk products.

Based on these results it was concluded that, with the exception of atmospheric-roll type of powder, dry skim milk produced normal ice cream. The atmospheric-roll type could be used if all undissolved particles were removed from the mixture before homogenizing. As a source of solids-not-fat for ice cream, dry skim milk proved very desirable.

VETERINARY MEDICINE

[Report of the department of veterinary science at the Indiana Station] (*Indiana Sta. Rpt. 1930, pp. 76–79*).—Reporting upon the diagnoses of diseases of livestock, mention is made of an anemic condition that has occurred on a farm in Pike County from which 25 horses have died within the past 5 years. An examination failed to reveal the presence of any of the common metallic poisons such as arsenic and lead, while a microscopic examination of the viscera showed marked anemia such as occurs in swamp fever.

In work with infectious abortion the antibody titer curves of the blood of 5 cows in the abortion herd remained at relatively constant levels, there having been no indication that these cows would cease to react to the agglutination test. In 2 cows the antibody titers were highest 4 months after they were infected with *Bacterium abortus* Bang, but subsided until at the time of writing the highest titers for these animals were 1 to 25 and 1 to 50. The 5 cows that showed a constant titer eliminated *B. abortus* in the uterine discharge following calving. *B. abortus* was isolated from the uterine discharge at the first calving only from the cows that at the time of writing showed a low antibody titer. During the lactation period the presence of this organism in the milk from each of the cows in the first or constant titer group was demonstrated, but it could not be demonstrated in the milk from the low titer group. A culture of *B. abortus* was injected through the milk ducts into the milk cisterns of 3 mammary glands of 2 sows that had just weaned their pigs, by means of a blunt hypodermic needle and syringe. The sows were bred a few days later, and during the gestation period 1 gave a positive and 1 a partial reaction to the agglutination test. The investigators were unable to isolate *B. abortus* from either the tissues of the pigs or udders of the sows that had been killed for examination a few days after farrowing.

An account is given of the treatment of anemia in pigs, a report of the pathology of which disease has been noted (E. S. R., 63, p. 774). The addition of ferrous iodide at the rate of 0.0656 per cent to the ration of 4 sows from the time they were bred and continued until the pigs were 4 weeks old did not have any appreciable preventive effect on the anemia. Eight pigs that were kept in a hog house covered with bluegrass sod for a few hours daily from the time they were 14 days of age at 4 weeks of age had an average hemoglobin content of 9.6 gm. per 100 cc. of blood, while 6 litter mates which did not have access to sod averaged only 4.9 gm. of hemoglobin per 100 cc. of blood. Twelve pigs from 3 litters were placed on bluegrass sod inside of a hog house for from 2 to 6 hours daily, beginning when the pigs were 4 days old, while 10 of their litter mates were placed on soil which was free from sod. At 4 weeks of age the pigs on the sod had an average hemoglobin content of 13 gm., while their litter mates on the soil had 10 gm. of hemoglobin per 100 cc. of blood.

Reference is made to the production of cholera serum and virus and pullorum antigen, tests made for the diagnosis of infectious abortion, and cholera serum and virus tests.

Report of the section of animal pathology, E. T. HALLMAN (*Michigan Sta. Rpt. 1929, pp. 149–151*).—Reporting on the work of the year (E. S. R., 64, p. 262), it is stated that studies by R. Quinet on vital staining of guinea pigs, the technic of which is described, indicate that the reticulo-endothelial cells play the important rôle in the reaction to abortion infection.

Reference is made to a study by I. F. Huddleson of the pathogenicity of *Brucella abortus* for monkeys, 8 having been exposed to the bovine type of the organism, 7 to the porcine, and 4 to the melitensis type. The results obtained

are considered to indicate quite clearly that *B. abortus* (Bang) is pathogenic for the monkey, in which it produces an undulant fever-like disease. Infection, however, is not readily produced, and in many cases does not occur at all. Monkeys are very susceptible to infection from a small dose of the *B. suis* or porcine type regardless of its source. In fact, the data indicate that this species is more virulent for the monkey than is *B. melitensis*.

In a study of the viability and virulency of commercial abortion vaccines in cooperation with J. P. Torrey, work was conducted with products of nine of the larger and better known manufacturers, the results of which are summarized as follows: "'Abortion vaccines from nine manufacturers were studied for viability and virulence. Of these our cultural data indicate that three were nonviable although tested 20, 72, and 76 days, respectively, before the expiration date stamped on label. The fourth failed to grow except for a few colonies on carbol fuchsin agar, indicating that the vaccine contained a few viable organisms. The virulency test with two of these four indicates that *they contained a few viable organisms. The five remaining vaccines* were viable. Two of these appear to be highly attenuated but not nonvirulent. One of the two apparently attenuated vaccines has been shown to consist of organisms possessing the property of acquiring considerable virulence when subjected to favorable conditions for the organisms. Three vaccines showed more virulence for guinea pigs than many recently isolated strains from aborting cattle.'"

[Report of work in animal bacteriology and parasitology], W. GILTNER (*Michigan Sta. Rpt. 1929, pp. 154–165*).—Reference is made to a study of *Brucella abortus* agglutinating sera for their bactericidal and therapeutic value, by H. M. Johnson, summarized as follows: "'The results presented in this paper, based upon the in vitro bactericidal study of 11 sera from human, bovine, equine, and caprine sources indicate that the hyperimmune bovine sera and the immune human sera show a slightly varying bactericidal zone in dilutions between 1 to 500 and 1 to 64,000, while the in vivo study of 5 sera, employing 235 guinea pigs, indicates that the bovine sera have a therapeutic value in dilutions between 1 to 32,000 and 1 to 1,024,000.'" It is concluded from these observations *that in a specific serum for B. abortus the bactericidal effect may* exhibit itself in a zone brought about by dilution. It is considered clear that the agglutinin production and the agglutinin titer are not a measure of the serum's lytic power.

Studies of the pathogenicity of the species for monkeys, in cooperation with E. T. Hallman of the section of animal pathology, indicate that *B. abortus* is pathogenic for monkeys, producing an undulant fever-like disease, although infection from the bovine form is not readily induced. Monkeys are, however, very susceptible to a small dose of the porcine form regardless of its source of origin.

It was found by J. P. Torrey that the agglutination test of milk serum from each quarter of the udder is a safe method of determining whether the milk from that quarter is safe in so far as *B. abortus* is concerned. The work indicates that live culture vaccination for udder streptococcus infections has possibilities, but has not as yet shown that this method is susceptible of commercialization.

It is stated that 75 head of cattle have been treated with streptococcic vaccine with favorable results. *Escherichia coli* was the predominating organism isolated from 50 animals brought to the laboratory for autopsy, 20 of which were calves that had died from pneumonia.

According to a report of work in parasitology by W. L. Chandler, critical experiments for the treatment of stomach worm infestations in sheep during

the preceding year (E. S. R., 64, p. 261) established the fact that a 4-oz. dose of suspension of colloidal iodine containing 1 per cent iodine and a sulfate in solution, administered by the drench method, readily entered the fourth stomach and was effective in killing the stomach worms in 97 out of 98 infested lambs thus treated. It was also shown that the use of sulfates may be avoided if the strength of the dose be increased proportionately; for instance, a 6-oz. dose of a 0.66 per cent solution proved to be effective under slaughterhouse conditions. It was observed, however, that many of the animals fought the drenching process to such an extent that much of the dose was often lost. In the experiments conducted during the past year, an attempt was made to administer the dose through a short, thick tube passed into the esophagus, and in order to facilitate passage of the dose directly into the fourth stomach without the use of sulfates the animals were held in various positions during the administration of the dose. The results of the administration to 83 animals showed the percentage of efficiency of animals lying on the right side to be 93.3; sitting on the haunches, front feet on floor, 88.5; standing on all four feet 66.6; and standing on hind feet 40.

Reference is made to the vermicidal value of iodine in the control of blackhead in turkeys. A reference is also made to experiments on the dosing of turkeys for the large tapeworm (*Hymenolepis* sp.), conducted in October in Alabama in collaboration with the Alabama Polytechnic Institute and D. J. Meador of Selma, Ala. It was found that while a 1-oz. dose of double strength iodine vermicide apparently did kill the tapeworms, it was not considered a sufficient volume to carry the free iodine throughout the length of the intestines in some cases of adult turkeys. It is recommended that a 2-oz. dose of colloidal iodine containing 2 per cent of iodine, 4 per cent of gum arabic, and 2 per cent of ferric chloride be administered into the gizzard by a turkey dosing appliance, since it was apparently wholly efficient in killing and removing the turkey tapeworms even when these were present in numbers equal to a 3-oz. volume.

H. J. Stafseth reported that the three flocks of about 1,200 birds immunized with *Staphylococcus aureus* bacterin the preceding year remained free from roup. Results obtained from cooperative experiments carried out with a commercial concern are said to have shown conclusively that the agglutination test is a very reliable means for detecting *Salmonella pullorum*, and that the disease can be controlled and even eradicated if proper sanitary measures are taken to prevent reinfection. The results of bacteriological and pathological examinations of the year are tabulated, and routine agglutination tests referred to.

[Report of the veterinary department of the Wyoming Station] (*Wyoming Sta. Rpt. 1930, p. 26*).—In the study of infectious abortion in range cattle, C. Elder found two bulls that reacted to the blood test for the disease, emphasizing the importance and necessity for testing bulls as well as cows in the work of eradicating the disease.

The study of tuberculosis of birds as related to the disease of cattle indicates that the skin form of tuberculosis of cattle is closely related to the form of the disease in chickens. A turkey received at the laboratory had tuberculosis of the skin caused by the avian type of the organism.

Several years of experimentation with *Bacillus necrophorus*, which causes calf diphtheria and other diseases of young cattle, has led to the preparation of a serum that gives some promise of immunizing animals to it.

[Poisonous plants in Wyoming] (*Wyoming Sta. Rpt. 1930, pp. 20, 21*).—In studies of the distribution of the poisonous substance in the various parts of the death camas plant made at different seasons of the year there was found to be more poison per pound of plant in the very early stages of growth.

and that at the time the seeds are maturing there is more poison per pound of seed head and more total poison in the seed head than there is in the very young plants. Thus it appears that the plant is dangerous from the time it first comes through the ground until it becomes so dry that it is no longer edible. On the Laramie plains this period was found to extend from the first week in May past the middle of July. Feeding experiments with sheep brought out the fact that sheep could be killed by about 0.80 lb. of young plants to 100 lbs. of the weight of the sheep. Some preliminary work indicated that lime water given to the poisoned sheep had a curative effect. Experimental eradication work under way indicates that cutting retards growth.

Analyses made of young larkspur plants showed that they have from 26 to 31 per cent of crude protein, and that they would make a valuable spring food if they were not poisonous. It has been found that there is very little danger from second-growth larkspur. From work on close cutting, O. A. Beath concludes that close grazing for two consecutive seasons will greatly retard the growth of larkspur.

It was found that flowering vetch (*Astragalus campestris*), when air dry, contains 20.6 per cent of crude protein, showing that the poisonous plant would have a high feeding value if it could be utilized.

Mountain-laurel (Kalmia latifolia) and sheep laurel (Kalmia angustifolia) as stock-poisoning plants, C. D. Marsh and A. B. Clawson (*U. S. Dept. Agr., Tech. Bul. 219 (1930), pp. 23, figs. 6*).—Following a brief introduction, the authors present descriptions and the history of *K. latifolia* and *K. angustifolia*, two species that produce the same effect, their poisonous properties being due to the same substance, andromedotoxin (pp. 1–4); an account of experimental work (pp. 4–11); a discussion and general conclusions, including symptoms, microscopic changes in animal tissues, toxic and lethal dosage, time from feeding to appearance of symptoms, duration of sickness, remedies, animals affected by the plants, conditions under which poisoning occurs, and poisoning by flesh of animals which have eaten Kalmia (pp. 12–20).

Cattle, sheep, and goats are the animals most affected, while horses are said to have been poisoned, and both men and monkeys may be poisoned. There is no definite evidence that wild animals are ever poisoned from grazing on these plants, although deer are susceptible to heavy forced feedings of mountain-laurel, as has been reported by Forbes and Bechdel (E. S. R., 64, p. 174). Methods of avoiding losses are indicated, and it is shown that oil or grease is an effective remedy in treating poisoned animals.

A list of 21 references to the literature is included.

The toxicity of Corydalis caseana, M. R. Miller (*Jour. Agr. Research [U. S.], 42 (1931), No. 4, pp. 239–243*).—This contribution from the Nevada Experiment Station reports on the preparation of the crude alkaloidal material and physiological tests of the toxicity for sheep of the alkaloids obtained from the plant referred to as "fit weed." The importance of the plant was called to attention by serious losses of sheep on certain portions of summer range in the Plumas National Forest, Calif. Chemical examination resulted in the preparation of from 1.1 to 1.9 per cent (on a dry basis) of crude alkaloidal material therefrom. Since a review of the literature indicates that the plants of this family are rich in alkaloids, it is presumed that there exists more than a single alkaloid in *C. caseana*. Physiological tests demonstrated the toxicity of the plant. The lethal dose for 200-gm. rats was equivalent to 0.0076 gm. of the crude alkaloids, or 24.4 gm. of fresh plant per kilogram of body weight.

Studies of the test tube agglutination test for the diagnosis of Bang's disease (contagious abortion), C. P. Fitch et al. (*Minnesota Sta. Tech. Bul.*

ings of concentration of *Bacterium abortus* antigens (pp. 3–21), relation of agglutinin content of serum to amount of serum used (pp. 22–24), comparison of antigens of several laboratories (pp. 24–30), effect of preservatives (pp. 30–36) and heat on the sensitivity of antigens (pp. 36–38), rate of agglutination at 37.5° C. in the incubator (pp. 38, 39), effect of storage temperatures on sensitivity of antigen (p. 39), effect of period of incubation of *B. abortus* on sensitivity of antigens prepared from such cultures (p. 40), discrepancies due to observation of agglutination tests (pp. 41–45), thermoagglutination of *B. abortus* antigens (pp. 45–52), and effect of stoppered test tubes in conducting the agglutination test (pp. 52–55).

It was found that maximum agglutination titers vary in accordance with the concentration of the antigen. In the dilutions usually employed in diagnosis work this is of importance in approximately 5 to 6 per cent of bovine serum samples, which is approximately 20 per cent of all bovine serum samples in which agglutinins can be demonstrated. Concentration of antigens in use in different laboratories showed significant variations. A method of standardization of the concentration of antigens is described. A preservative was found desirable for *B. abortus* antigens. Phenol 0.5 per cent was efficient and satisfactory, but cresol and formalin did not prove satisfactory. From the standpoint of sensitivity, there was no advantage or disadvantage of heating bacterial suspensions for the production of antigens.

"Routine agglutination tests held in the incubator at 37.5° could not be safely observed until 48 hours. The sensitivity of antigen containing 0.5 per cent phenol was not appreciably influenced when held at refrigeration or room temperatures for long periods of time. The only factor which should govern the length of time cultures are incubated for the production of antigen appears to be a maximum growth, which is usually desirable but not essential. The reading of agglutination tests can be, and probably frequently is, a cause of discrepancy in the results obtained. This discrepancy was confined entirely to tests with medium agglutinin content sera. A phenomenon of 'agar thermoagglutination' is described. The stoppering of agglutination test tubes with corks did not appreciably influence the agglutination reaction."

Anaplasmosis in cattle, G. W. Stiles, jr. (*U. S. Dept. Agr. Circ. 154* (*1931*), *pp. 11, figs. 4*).—This is a practical summary of information on anaplasmosis in cattle, which has in recent years been recognized in the United States and has been a source of considerable loss. The account deals with the nature of the disease, its geographical distribution, symptoms, economic losses caused, description of the parasite, changes in affected red cells, the mortality, post-mortem findings, differential diagnosis, occurrence following dehorning, probable means of transmission, and treatment. It is pointed out that the causative agent, a microparasite, can be transmitted from sick or carrier cattle to healthy ones by means of certain ticks or by veterinary instruments.

An analysis of reputed pathogenicity of Thysanosoma actinioides in adult sheep, R. O. Christenson (*Jour. Agr. Research* [*U. S.*], *42* (*1931*), *No. 4, pp. 245–249, figs. 2*).—This is a contribution from the Minnesota Experiment Station on the fringed tapeworm. The data presented, which include the results of experimental examination of sheep, led to the conclusion that the symptoms associated with infection with *T. actinioides* are often confused, and that it has therefore been given undue pathogenic importance. The post-mortem studies of over 1,200 sheep, here reported, have shown that in well-organized feed lots no great damage is done to the host except where excessively heavy infections occur. In cases of heavy infection the symptoms simulate those of malnutrition, which fact should be given due weight before the mortality is attributed to the presence of a few thysanosomes in the liver. The conditions prevalent

in the ailing sheep examined were found as described by Wing (E. S. R., 26, p. 368) fairly similar to those of sheep suffering from apoplexy, or to what has been termed by Newsom and Cross (E. S. R., 54, p. 277) as "overeating."

The liver appears to be part of the normal habitat of the parasite. Whether the migration to that locality is cyclic or not can not be said, but it is evident that the parasite occurs there almost as frequently as in the intestine. Even where the liver infection is most heavy, analyses show that bile is present in both the duodenum and feces. Undoubtedly, the flow is not of normal regularity.

[Control of stomach worms by sanitation and drenching], E. H. Hostetler et al. (*North Carolina Sta. Rpt. 1930, pp. 79, 80*).—In continuation of work of the preceding year (E. S. R., 63, p. 672), the authors report that the wether lambs in the check lot, which lacked the sanitary measures, were not drenched and were grazed with the ewes on permanent pasture, contained considerably more worms when slaughtered upon attaining approximately 70 lbs. weight than did those in the groups that were drenched or received the sanitary measures in addition. The degree of infestation of the drenched lambs slaughtered seemed to vary closely with the length of time that had elapsed since their last drenching. When only a few days had elapsed they were found to be practically free from stomach worms, but when nearly a month had elapsed they were almost as wormy as the lambs slaughtered in the check group.

In work at the Piedmont Substation the ewe lambs in the first group were drenched at 28-day intervals and in the second group at 14-day intervals. Both groups were kept off feed for about 20 hours before drenching and off both feed and water for about 6 hours after drenching. At the commencement of the test both groups averaged 57.2 lbs., while at the end of the first 28-day period the lambs in the first group averaged 61.6 lbs. and those in the second group 64.4 lbs. For the 112 days, from June 10 to September 30, that the lambs were on test those in the first group made an average gain of 20 lbs., or an average daily gain of 0.18 lb., while those in the second group made an average gain of 29.2 lbs., or an average daily gain of 0.26 lb. The more frequent drenching showed an average gain of 46 per cent more for the entire period. The 6 most desirable and best grown lambs were selected to be retained in the flock when the trial was closed. When this selection had been made it was found that 4 of these 6 lambs were from the second group.

[Poultry disease studies at the Iowa Station] (*Iowa Sta. Rpt. 1930, pp. 23, 58, 59*).—In continuation of the work of the previous year (E. S. R., 64, p. 882), it was found that the pullorum-resistant parents gave progeny that possessed more resistance to typhoid than did unselected White Plymouth Rock parents. It is pointed out that the testing of birds selected for resistance to one disease by subjecting them to another disease was a new phase of the problem just commenced.

Tuberculosis was found to be the cause of the greatest loss in farm poultry in Iowa, followed by tracheitis, worms, roup, and colds. Tracheitis, which caused the greatest loss to produce men, was found to be infectious, usually running a rapid acute course and frequently complicated by fowl cholera. Evidence accumulated suggests that its cause is in the nature of a filtrable virus.

Investigations of septicemic diseases among fowls: Studies of fowl typhoid, R. S. Dearstyne (*North Carolina Sta. Rpt. 1930, pp. 146–150*).—A brief report is given of studies of the artificial infection of birds by inoculation 30, 60, and 90 days after receiving one, two, and three vaccinations.

In studies of soil infection a pen was seeded on November 12 with 5 qt. of the specific strain of *E[imeria] sanguinaria* used in the studies, 6 pullets which had not received the prophylactic vaccination being added to the pen as check fowls on November 14. Between November 28 and February 16, 18 birds were taken from the cage and artificially infected, 15 of which, probably in the carrier stage, were returned to the pen, 2 of which died of typhoid as did 1 of the check birds. Two of the 5 remaining check birds died of causes other than typhoid, while of the 8 birds vaccinated and not artificially infected none showed any evidences of typhoid.

Studies on bacteriophage in relation to Salmonella and pullorum disease, W. L. MALLMANN (*Michigan Sta. Tech. Bul. 109 (1931), pp. 15*).—In the introductory résumé it is pointed out that in such diseases as dysentery, typhoid, and staphylococci infections treatment with bacteriophage has apparently lessened the severity of the disease, and, in many instances, has effected rapid recoveries.

In the studies reported it was found that "bacteriophage from one organism was easily adapted to another by the use of mixed cultures. Maximum activity of bacteriophage is generally reached within a few generations. Bacteriophage when injected into *S. pullorum* infected hens was apparently completely eliminated from the body within a few hours as evidenced by its absence in the feces and organs of the bird. Bacteriophage had no therapeutic value in the treatment of adult fowls naturally infected with *S. pullorum*. In naturally or artificially infected chicks bacteriophage had no therapeutic value. Bacteriophage has no prophylactic value in baby chicks exposed to *S. pullorum* infection. Bacteriophage lytic for *S. pullorum* in vitro had no lytic properties in vivo, as evidenced by its inability to effect a cure or to eliminate susceptible organisms from the body. Susceptible *S. pullorum* was obtained from the same tissue as an active bacteriophage lytic for the organism isolated. Large doses of bacteriophage caused an increased susceptibility to pullorum infection in chicks. Small doses in baby chicks had no significance."

A list is given of 14 references to the literature.

Study of the intermittent reactor to the agglutination test for pullorum disease (bacillary white diarrhea), R. S. DEARSTYNE (*North Carolina Sta. Rpt. 1930, pp. 143–146*).—In reporting further upon the project under way for three years (E. S. R., 61, p. 770), the prevalence of the intermittent reactor and the development of antibodies in progeny of reactors are considered in some detail. In reporting upon an intermittent reactor tested every 30 days it is pointed out that this fowl would not have been positive in a 1:25 dilution in six tests. This resulted in the adoption of the short-interval method of testing in the State. The results of one season's testing at short intervals indicated that unexplainable outbreaks of pullorum disease may occur when least expected.

Short interval testing as a control of pullorum disease, R. S. DEARSTYNE, R. E. GREAVES, and H. C. GAUGER (*North Carolina Sta. Tech. Bul. 40 (1931), pp. 31, figs. 8*).—The data here presented are the results of studies conducted in the 3 flocks of reactors maintained by the station for the past 4 years and the application of control measures worked out in North Carolina during the last hatching season on the basis of these studies.

It is concluded that while pullorum disease is transmissible from adult carrier to negative adult through cohabitation, the actual means of transmission remaining to be determined, such transmission is probably slow. Contact cases in adults rarely show symptoms such as would cause their elimination as sick birds, although mild bacteremias possibly exist in such fowls.

"In a study of 116 chicks from known reactors, 26, or 22.4 per cent, proved negative up to 6 months of age. The agglutination test applied to the 90 remaining birds at 30-day intervals from the second month on detected all of the carriers in the 5 tests conducted from the second to the sixth month. The dilutions used were 1:25 and 1:50. Experimental tests on 3 flocks of reactors showed 44 per cent of 27 birds in flock 1; 73.1 per cent of 27 birds in flock 2; and 69.2 per cent of 26 birds in flock 3 as intermittent reactors. The short-interval testing of birds in the field showed 1,859, or 26.8 per cent, of 5,053 reactors as being of the intermittent type.

"No constant genetical factor could be found as active in breeding of constant and intermittent reactors. No relationship could be determined as to serum titer and the delivery of infected eggs. Bacterial analysis showed 940, or 16.9 per cent, of 5,560 eggs laid by intermittent reactors to be infected, while 664, or 16.1 per cent, of 4,412 eggs from constant reactors proved positive. No relationship could be established as to duration of intervals of positive test and of negative test in intermittent reactors. Application of the short-interval test made on 280 breeding flocks containing 37,893 birds supplying hatcheries in North Carolina showed 44, or 15 per cent, accredited without reactors on the first 2 tests; 68, or 24.3 per cent, were accredited on 3 tests; 89, or 31.8 per cent, on 4 tests; 29, or 10.5 per cent, on 5 tests; 1, or 0.4 per cent, on 6 tests; and a residue of 49, or 17.5 per cent, remained unaccredited at the termination of the sixth test. Of these 49, 33 had 1 negative test at the time the work was discontinued.

"Figures cited indicate that as flock size increases the percentage infection decreases. Progressive reduction of infection in flocks from the time of initial test until the work was terminated was noted in 189, or 80.1 per cent. Age or sex apparently exerted no influence on the percentage of intermittent reactors as determined by field studies. The output of the hatcheries under test indicated the short-interval method of testing was effective in a great reduction of pullorum disease in this State."

A list is given of 25 references to the literature.

Developmental stages of some nematodes of the Spiruroidea parasitic in poultry and game birds, E. B. Cram (*U. S. Dept. Agr., Tech. Bul. 227 (1931), pp. 28, pl. 1, figs. 25*).—Following a review of the earlier work and methods used in the present investigation, the author reports upon the development in the intermediate host and in the final host of *Tetrameres americana* Cram, 1927; *Cheilospirura hamulosa* (Diesing, 1851) Diesing, 1861; *C. spinosa* Cram, 1927; *Dispharynx spiralis* (Molin, 1858) Skrjabin, 1916; and *Seurocyrnea colini* (Cram, 1927) Cram, 1930.

These nematodes represent the three families Spiruridae, Acuariidae, and Tetrameridae, which occur in birds. In one case, involving a member of the Spiruridae, *Gongylonema ingluvicola*, the adult nematodes were developed experimentally in a chicken and a rabbit from larvae found in natural infestations in the dung beetles *Phanaeus vindex* and *Copris minutus*. In the other cases the entire life cycle was artificially produced. For a second member of the Spiruridae, *S. colini*, the German cockroach was found capable of serving as intermediate host. Of the Acuariidae, *Cheilospirura hamulosa* and *C. spinosa* were developed in grasshoppers (the red-legged and the differential grasshopper) as intermediate hosts, and *Dispharynx spiralis* was developed in isopods (*Porcellio scaber* and *Armidillidium vulgare*). Of the Tetrameridae, *Tetrameres americana* was developed in grasshoppers (the red-legged and the differential grasshopper). Experimental development of the adult spirurids was accomplished in the following bird hosts: *T. americana* in the chicken

(*Gallus gallus*), domestic duck (*Anas platyrhyncha domestica*), domestic pigeon (*Columba livia domestica*), bobwhite quail (*Colinus virginianus*), and ruffed grouse (*Bonasa umbellus*); *Cheilospirura hamulosa* in the chicken; *C. spinosa* in bobwhite quail and ruffed grouse; *D. spiralis* in bobwhite quail, ruffed grouse, and the domestic pigeon; and *S. colini* in bobwhite quail and, as immature specimens, in the chicken.

AGRICULTURAL ENGINEERING

[Agricultural engineering investigations at the Indiana Station] (*Indiana Sta. Rpt. 1930, pp. 8–13, figs. 4*).—In the corn borer control studies plow coverage tests, made to determine the cornstalk coverage ability of different size plow bottoms and the value of trash wires or shields and large coulters and jointers plowing at a depth of 7 in., gave a coverage of 99.1 per cent with 14-in. bottom plows and 99.3 with 16-in. and 18-in plows. At a depth of 8 in. these plows each gave a coverage of 99.5 per cent. A check made with the same types of plows without trash wires or shields and the regular coulters and jointers plowing at a depth of 7 in. gave a coverage of 95.2 per cent, or left 6.2 times as much trash exposed as when these special devices were used. The use of electric current to kill corn borers in either growing or dry stalks did not seem practical because of the high resistance of the borer and the very poor conductivity of either green or dry stalks.

Low cutting attachments for combines for harvesting soybeans were found to reduce the cutter-bar losses in proportion to the lowness of cutting. In order to reduce cutting losses to a minimum without causing other serious handicaps, a combine should be able to cut soybeans 2 in. above the ground on level land. The use of windrow and pick-up attachments in harvesting soybeans increased the loss of beans. The soybeans did not cure well in the swath because the stubble was too short to support the swath off the ground. Windrow and pick-up attachments were found to be satisfactory for harvesting wheat, but unless weed or clover growth was unusually rank windrowing was not necessary for satisfactory combining of wheat.

The use of insulation and ice in one room of the partially below ground apple storage at the Moses Fell Annex farm near Bedford reduced temperatures from 5 to 14° F. below those in the air-cooled room. It was possible to maintain the temperature in the iced room below 50°. The greatest difference in temperature between the two rooms was during the warmest weather. Grading of Grimes and Jonathan apples in storage from September 16 to December 16 showed 4 per cent more sound fruit in the iced room than in the air-cooled room. The relative humidity in the iced room remained very close to 90 per cent, which was approximately 10 per cent higher than that of the ventilated room. Both Grimes and Jonathan shriveled more quickly in the ventilated room than in the iced room. Smoke tests showed a complete air change every 5 minutes in each room when the exhaust fans were operated. The cost of ice and electricity was 14 cts. per bushel in 1929–30 as compared with 18 cts. in 1928–29. Before the room was insulated the cost was 23.5 cts. per bushel in 1925–26 and 26.9 cts. in 1926–27.

In the terracing studies on the Paoli field no noticeable erosion took place in terrace flow lines with grades as steep as 0.7 ft. per hundred feet when the field was in clover and timothy sod. When in wheat, erosion took place in flow lines with a fall of over 0.5 ft. per hundred feet. When the field was in corn, some erosion took place in terrace flow lines with a fall of over 0.4 ft. per hundred feet. When the grade of the flow line was less than 0.3 ft. per hundred feet there was not sufficient grade to keep the flow line clear of the

soil which washed into it from between terraces. In sections in which corn rows crossed the terraces it was necessary to clean out the flow lines with shovels.

In poultry housing studies 4 years' results showed no definite benefits in winter of long time egg production arising from the use of insulation or special ventilation devices. Although extreme drops in outside temperature were not accompanied by as severe changes in the insulated houses as in the uninsulated pens, there was very little difference in egg production. Pen temperatures maintained above 40° by means of artificial heat did not increase egg production. Birds confined in an open-front house maintained egg production until April, but after that laid less eggs than did birds permitted to go outside each day. The mortality also increased among the confined birds.

In grain and hay drying tests hot air blown through freshly cut alfalfa on false bottoms in large sheet-iron tanks dried the hay at the rate of 400 lbs. of dry hay per hour. The hay was cut and blown into the tank with a silage cutter. This recut hay packed together readily and required stirring to permit the air to pass through it and carry off the moisture. The same equipment was satisfactorily used for drying wheat which had passed through the hot water treatment for smut. Three thousand bushels of river bottom corn were dried in the crib by forcing heated air up through an air distributing tunnel, 2 ft. wide and 2.5 ft. high, built through the middle of the crib and extending its full length. The corn, as it came from the field, contained from 60 to 70 per cent of moisture in the cob and from 30 to 40 per cent in the grain. After treatment the grain contained 18 per cent and the cob 30 per cent of moisture. The cost of fuel and labor was 3 cts. per bushel.

In studies of uses of electricity the use of a 10-h. p. motor to drive a 20 by 32 thresher was shown to be satisfactory for threshing wheat, oats, and soybeans. Records of electric brooders operated on Indiana farms in 1929 and 1930 during April, May, and June indicate that fuel costs for electricity at 3 cts. per kilowatt hour may be considerably less than for hard coal at $16 per ton. This difference is largely attributable to the practice of cutting off the current to the brooder on warm days. Brief data also are given on the cost of milk cooling with electric refrigerator, power cost for stationary spray plant, and cost of grinding oats.

[Agricultural engineering investigations at the Iowa Station] (*Iowa Sta. Rpt. 1930, pp. 9–11*).—Studies in the waterproofing of the tile roof of a masonry arch barn indicated the value of an asphalt paint of a sufficiently high melting point to resist the heat of the sun. Although fiber paints proved satisfactory, they are expensive. The cost of roof treatment with asphalt and aluminum paints is reasonable, the cost of the material being approximately $2.50 per square (100 sq. ft.).

In studies of stall floors for dairy barns, over a period of 10 years, it was found that the bituminous concrete type failed completely, the concrete and rubber type showed little or no wear, bituminous floors laid over concrete and tile showed considerable distortion and required replacing, and cork brick and wooden block resisted wear but were not satisfactory from a sanitary standpoint.

Tests of a fan system of mechanical ventilation for dairy barns driven by electric motors indicated that such a system has much merit where a reliable source of electric current is at hand. The control of ventilation is much more positive than where the rarefaction of air due to heating is used to induce circulation for ventilation.

Brief data also are presented on cost of creamery buildings, harvesting corn

The harvester-stacker method of harvesting grain in North Dakota, H. F. McColly (*North Dakota Sta. Bul. 245 (1930), pp. 27, figs. 22*).—The results of an investigation into the harvester-stacker method of grain harvesting are reported. This method involved the consideration of a machine composed of a 12-ft. header which elevates the headed grain into a metal container approximately 7 ft. in diameter. The bottom of this container or tank revolves so that the grain is deposited in it in layers or coils, with the heads inclined toward the center and the butts of the straw toward the outside. The stack is built in this tank, being packed by a revolving corrugated conical packer at the top and a cylindrical roller at the side near the bottom. The finished stack is approximately 6 ft. high and so woven and packed that it resists weather very well, yet the grain is easily pitched into a thresher without scattering. The stack is dumped by power lifting the rear half of the tank, the tank having traveled to the rear of the carriage track. The tank bottom inclines to the rear, and the stack slides off.

The results showed that stacks built by the machine when properly operated protect the grain from excessive shrinkage, and the quality of both grain and straw is improved by the stack going through the sweating process. The stacks are more easily hauled to the thresher on the sweep rake than bundle grain on racks. The stacked grain is as easily pitched into the extension feeder as bundle grain into a feeder.

This method saves all the straw except in a tall crop. Since the best stacks are built from straw about 18 in. long, no more than a binder would leave is left in the field when the standing crop is around 30 in. in height. This method also develops a high quality of grain and straw, and provides a temporary grain storage in the stack if necessary. Comparing it with some other harvesting methods, it saves labor, time, twine, permits earlier plowing, and does not scatter foul weed seeds over the field.

Husker-shredders in corn-borer control, I. F. Reed and W. R. Humphries (*U. S. Dept. Agr., Farmers' Bul. 1662 (1931), pp. II+17, figs. 17*).—This publication is based on tests conducted on husker-shredders. It describes the operation of the machines and makes suggestions as to their operation and care, with special reference to corn borer control.

It has been found that, with proper adjustment and careful operation, husker-shredders kill from 95 to 98 per cent of the borers in the stalks. Most of the borers are killed while passing through the snapping rolls. Shredder heads, combination heads, and knife heads cutting 2 in. or less are about equally effective in destroying corn borers. The greatest number of borers are killed when fodder is cut into 0.5-in. lengths and the least number when the fodder is cut into 4-in. lengths. Live borers in the stored fodder in excess of 2 per cent may become a source of increased infestation.

AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY

[Investigations in agricultural economics at the Georgia Station, 1930] (*Georgia Sta. Rpt. 1930, pp. 37–43, figs. 3*).—In addition to results previously noted, a table is included showing the grade, staple length, and tenderability of cotton ginned in Georgia in 1929 and prior to November 1 in 1930.

Tables based on 3,836 records of carlot shipments of Georgia peaches are given showing for 1928, 1929, and 1930 the percentage of marketable and cull peaches and the causes of culls.

[Investigations in agricultural economics at the Indiana Station, 1929–30] (*Indiana Sta. Rpt. 1930, pp. 44–46, figs. 2*).—Results not previously noted are reported as follows:

A study of the cost of picking and cribbing corn on 60 farms in central Indiana showed that the cost per acre, cost per bushel, and man labor requirements per acre were for hand husking $3.98, 10 cts., and 4.75 hours; for 1-row pickers $3.41, 8.8 cts., and 2.83 hours; and for 2-row pickers $2.42, 5.9 cts., and 2.06 hours.

A study conducted on central Indiana farms, 33 each with general purpose and ordinary tractors and 33 without tractors, showed that on 261-acre farms general purpose tractors displaced an average of 5.2 work horses and 8.6 months of man labor, and ordinary tractors displaced 3.5 horses and 4.6 months of man labor. The average numbers of crop acres handled per man were 75.3 on horse farms, 88.5 on ordinary tractor farms, and 106.2 on general purpose tractor farms. The drawbar power cost per acre of crops was approximately the same for all three groups. General purpose tractors averaged 579 hours of work at a cost of 66.7 cts. per hour, and ordinary tractors 373 hours at a cost of 78.9 cts. per hour. The amounts of livestock handled were practically the same for the three groups of farms.

A continuation of the pasture study (E. S. R., 63, p. 585) showed that the cost of rotation pasture is higher in proportion to its carrying capacity than that of permanent pasture. The average annual costs per animal unit were for bluegrass $5.72, red top and timothy mixed $14.07, clover and timothy mixed $12.03 timothy $11.65, and sweetclover $7.89.

The results in 1929 of the combine harvester thresher study (E. S. R., 63, p. 585) showed that the average cost per acre for all crops harvested was $2.03 for combines, as compared with $2.02 in 1927 and $2.27 in 1928. The costs with binders and threshers were in 1929, $3.53; in 1927, $3.18; and in 1928, $3.33 per acre. The costs per bushel were less with combines than with harvesters and threshers where more than 130 to 140 acres were harvested.

[Investigations in agricultural economics at the Iowa Station, 1929–30] (*Iowa Sta. Rpt. 1930, pp. 7–9*).—Results of studies made showed the following:

Gross income from the 10 principal agricultural commodities increased about 9 per cent from 1928 to 1929. The average index numbers of farm prices for these commodities increased from 145 to 147.

The percentage of the total number of Iowa hogs marketed by truck increased 11 per cent from 1928 to 1929, being 25.8 per cent in 1929. Public stockyards in 1929 received 44 per cent of all hogs trucked, packing plants 34 per cent, and reload stations 22 per cent.

Detailed records from 39 Webster County farms indicated an 11 per cent increase in price of hogs and a 24 per cent increase in pork production in 1929 over 1928. The increase resulted from 18 per cent more litters, 7 per cent more pigs raised per litter, and 5 per cent increased weight of hogs sold. The corn-hog ratio increased from 10.9 to 11.7. Daily gains increased from 0.76 to 0.91 lb.

Economic periodicals of foreign countries published in the English language: A selected list, compiled by L. O. Bercaw, rev. by M. I. Herb (*U. S. Dept. Agr., Bur. Agr. Econ., Agr. Econ. Bibliog. 11, rev (1930), pp. [3]+28*).—This is a revision of the list previously noted. (E. S. R., 54, p. 782).

The agricultural credit situation in Kentucky, H. B. Price, C. J. Bradley, and E. C. Johnson (*Kentucky Sta. Bul. 311 (1930), pp. 547–600, figs. 6*).—This is a preliminary study based on data secured by field studies and questionnaires from Federal and joint stock land banks, commercial banks, life insurance companies, merchants, individuals, and county records. The agricultural regions, the agricultural investment in the several regions of the State, and the capital requirements of Kentucky agriculture are described. The extent, sources, and purpose of farm mortgage credit, size of the loans, ratio of mort-

gage indebtedness to farm value, interest rates, foreclosures, short-term credit, and the operations of the Federal intermediate credit bank in the State are discussed.

Kentucky agriculture uses about $200,000,000 credit annually, of which about 60 per cent is borrowed on mortgages to finance land and improvements and about 40 per cent is short-term credit for production and consumption purposes. Commercial banks are the more important sources for both types of credit. Farm mortgage loans are not uncommonly for 12 months or shorter periods, and production loans for 30 to 60 days. This practice of the commercial banks is probably the chief factor in the increase of loans during recent years by the Federal land bank and other similar agencies providing for long-term amortization of loans. Borrowing to refinance existing indebtedness has become more important in recent years due to the transfer of short-term to long-term loans on an amortization plan and to necessity due to declining farm incomes and falling agricultural prices. Prevailing rates on first mortgages reported by 203 State and national banks ranged from 6 per cent in 3 districts of the State to 7.2 per cent in 2 districts. Rates on second mortgages reported by 82 banks varied from 6 to 7.4 per cent.

Assessment ratios of forest property and other real estate in Wisconsin, R. C. Hall (*U. S. Dept. Agr., Forest Serv., Forest Taxation Inq. Prog. Rpt. 12 (1930), pp. [5]+15+[19], pls. 4*).—This is a study of the relation of assessed values on different classes of land to sale price as shown by records of the Wisconsin State Tax Commission in 17 northern or forest counties, in which less than 40 per cent of the land area is in farms; in Richland County, a southern county in which wood lots are important; and in Shawano County, an intermediate county where neither forest nor farm interests predominate.

Tables are included and discussed showing the ratios of the assessed values and equalized assessed values to sale prices in the 19 counties for farm, cut-over, timber, resort, residential and business, and unclassified lands and village and city properties. A more detailed study is made of the assessment ratios and their variability in 6 counties, 3 with the largest number of sales of cut-over properties and 3 with the largest number of timber property sales.

The study shows (1) that as to assessments timber lands, resort, and residential and business properties are the most favored classes, that farm lands are assessed at practically the same ratio as the average of all the properties and are underassessed as compared with cut-over lands, and that city and village properties are generally assessed somewhat higher than the average of all properties; (2) that farms are assessed with more certainty and less variations and timber lands with less variations than cut-over lands; and (3) that while the Wisconsin equalization system may make reasonable distribution of taxes between taxing districts, it is inclined to increase rather than reduce misplacement of State and county taxes between property classes.

Tax delinquency in the selected counties of Oregon and Washington, D. Pingree (*U. S. Dept. Agr., Forest Serv., Forest Taxation Inq. Prog. Rpt. 11 (1930), pp. [4]+9+[14], pls. 4*).—This report is based on field investigations in 1928 in Baker, Clatsop, Coos, Grant, Klamath, Lane, and Tillamook Counties, Oreg., and Clallam, Grays Harbor, and Lewis Counties, Wash. The acreage assessed in 1926 by land classes, the acreage of different types of land delinquent under the 1926 and prior levies, the acreage foreclosed on and still held by the counties, the effects of delinquencies on tax collections in 1927, and the trends of delinquencies, 1918–1928, on different types of land in Clatsop and Tillamook Counties, Oreg., and Grays Harbor and Lewis Counties, Wash., are discussed. A special study was also made of delinquency in selected areas in each of the counties included in the study.

Piedmont farm management for 1931, W. C. Jensen and B. A. Russell (*South Carolina Sta. Circ. 46 (1931), pp. 15*).—The most important material from the studies previously noted (E. S. R., 39, p. 294; 52, p. 588; 56, p. 286; 63, p. 385; 65, p. 80) is summarized, the agricultural outlook for 1931 is discussed, and a farming system for 1931 is suggested.

Present and prospective development of farming systems in western Montana, S. E. Johnson (*Montana Sta. Bul. 239 (1930), pp. 72, figs. 26*).—This study was begun in 1927 to learn some facts that would serve as the background for more detailed research in special sections of the area and help in outlining an extension program based upon comparative advantages in production. It is based on Federal, State, and county records and reports, data from irrigation companies, and about 300 farm-survey records. The area, its agricultural development, and present land utilization are described. The present farming systems and the factors influencing their development and the price trends of the important cash crops and livestock products are discussed, and suggestions are made for development policies on the various classes of land. Illustrative farming organizations for different types of farms of irrigated or subirrigated lands, a cattle ranch, a sheep ranch, 320- and 640-acre farms on nonirrigated tillable land, and a medium sized farm on cut-over land are outlined and returns estimated.

Cattle ranch organization and management in western South Dakota, M. B. Johnson (*South Dakota Sta. Bul. 255 (1930), pp. 55, figs. 12*).—The results of a study of detailed records of 15 South Dakota cattle ranches for the years 1926–1928 are presented and other data relating to cattle ranching in the State are analyzed. The records were collected as an extension of the cooperative study previously noted (E. S. R., 59, p. 181).

The natural conditions and range cattle production of the northern Great Plains region are described. Tables with discussions are included showing for each of three districts in the South Dakota range area the amount and type of land operated, cattle inventories and changes therein, investment by items, crop production and values, and ranch receipts, expenses, and income on representative ranches. Reorganizations are suggested and estimates made of receipts, expenses, and income under different conditions on the reorganized ranches.

The principles of ranch organization, range cattle management and marketing, cash crops and feed production, and the land situation in the area are discussed.

Selecting the most profitable system of dry-land farming in eastern New Mexico, L. H. Hauter, A. L. Walker, and O. V. Wells (*New Mexico Sta. Bul. 188 (1931), pp. 41, figs. 9*).—This bulletin, the third of the series previously noted (E. S. R., 64, p. 783), briefly summarizes the preceding bulletins and shows by the method of budgeting the income that may be expected from different farming systems under certain conditions and a method for use by the individual farmer in estimating his farm income.

Making cotton cheaper: Can present production costs be reduced? M. G. Vaiden, J. O. Smith, and W. E. Ayres (*Mississippi Sta. Bul. 290 (1931), pp. 32, figs. 27*).—Tables are included showing the cost in 1930, by items, on two cotton plantations operated with quarter hands (planter furnishing land and 0.25 of the cottonseed and fertilizer and receiving 0.25 of the cotton raised), two with half hands (planter furnishing everything but labor and 0.5 of the fertilizer and taking 0.5 of the cotton raised), one with about 45 per cent of quarter hands and 55 per cent half hands, and five tractor-operated plantations. Other tables show the utilization of land on the tenant- and tractor-operated plantations and the cost per acre of different cultivation operations with various units of equipment at the Delta Substation in 1929 and 1930. The use of mechanical cotton pickers is briefly discussed.

The tenant charges, other operating expenses, administration costs, and interest and depreciation under the different systems of operation were, respectively, for quarter-hand plantations $50.16, $5.44, $6.63, and $15.73; half-hand plantations $16.13, $15.65, $7.57, and $13.25; all tenant plantations $30, $10.11, $6.67, and $13.78; and tractor plantations 0, $19.94, $5.84, and $9.83. The average cultivation costs, 1929 and 1930, per acre for operations having variable costs with different units of equipment and the estimated number of acres handled per man at the Delta station were for half-row or 1-horse $13.09 and 15 acres, 1-row or 2-horse walking cultivator $10.35 and 24 acres, 1-row or 2-horse riding cultivator $9.77 and 30 acres, 2-row or 4-horse $8.11 and 50 acres, 2-row tractor $6.62 and 65 acres, and 4-row tractor $5.24 and 120 acres.

[**Cotton marketing**], J. G. Knapp (*North Carolina Sta. Rpt. 1930, pp. 35–39, figs. 3*).—Grade and staple reports from 46 gins for the 1929–30 crop showed the following average grades and staple lengths for the Tidewater, Upper Coastal Plain, and Piedmont regions, respectively: White middling and better 21.34, 57.22, and 68.81; white strict low and low middling, 57.86, 25.53, and 10.20; 15/16 and 1 3/32 in., 18.31, 26.17, and 27.26; ⅞ and 29/32 in., 59.03, 64.93, and 66.70; and under ⅞ in., 22.64, 8.67, and 5.98.

Data for 1928–29 showed that the percentages of the total production and consumption of cotton in the State for the different staple lengths were, under ⅞ in. 10 and 2.2, ⅞ and 29/32 in. 69.4 and 24.5, 15/16 and 1⅛ in. 19.7 and 68.1, and 1 3/16 in. and over 0.9 and 5.2.

The average price differentials per bale for different white grades from that of the middling grade in local and central markets were for good middling +10 cts. and +$2, strict middling +20 cts. and +$1.30, strict low middling −$1.05 and −$3.50, and low middling −$3.90 and −$7.20; and for staple lengths from that of ⅞-in. staple, 13/16-in. and shorter −55 cts. and −$2.50, 15/16-in. +15 cts. and +$1.35, 1- and 1 1/32-in. +25 cts. and +$4.10, and 1 1/16- and 1 3/32-in. +$1.15 and +$8.05.

Cotton marketing studies, 1925–1930, W. C. Jensen, M. Guin, and H. A. White (*South Carolina Sta. Bul. 270 (1931), pp. 79, figs. 31*).—The results of the studies made from 1925 to 1930, inclusive, in cooperation with the Bureau of Agricultural Economics, U. S. D. A., are reported. The importance and economic problems of production and marketing of the industry, the quality of South Carolina cotton, the factors affecting staple length and grade, the marketing processes, prices in local and central markets, and the demands of South Carolina and United States mills are discussed.

The production in South Carolina during the period varied from 725,000 to 1,030,000 bales per year, while the demands of the mills of the State varied from 1,029,797 to 1,245,582 bales. Staple ⅞ in. or shorter constituted 30 per cent of the United States consumption and 21 per cent of that of the South Carolina mills. The studies indicate that of the 1928 and 1929 crops of American upland cotton in South Carolina, 89.6 and 85.4 per cent, respectively, were tenderable on contracts, 61.9 and 64.1 per cent were ⅞ in. or shorter staple, and 72.9 and 68.5 per cent graded middling or better. Variety was the most important factor affecting quality, and early pickings and ginnings had much better quality than the later ones. Local market prices tended to average below central market prices. There was a wide variation in the price paid for the same staple of white cotton in the nine markets studied. The study of staples and grades showed that in the local markets cotton is not being bought to any great extent on a strictly quality basis. The weighted average for all the markets studied showed a small tendency to recognize grade by giving very small premiums and discounts. Local markets paid more for shorter staples and poorer grades and less for longer staples and better grades than did central markets.

An appendix includes 25 tables on acreage, ginnings, staple, grade, prices, and manufacture for the use of extension workers, teachers, and others.

Marketing apples grown in the Cumberland-Shenandoah region of Pennsylvania, Virginia, and West Virginia, C. R. SWINSON, J. J. VERNON, F. F. LININGER, F. P. WEAVER, and A. J. DADISMAN (*U. S. Dept. Agr., Tech. Bul. 234* (*1931*), *pp. 51, figs. 5*).—This study, made in cooperation with the Virginia, West Virginia, and Pennsylvania Colleges of Agriculture, is based chiefly on data obtained from growers, dealers, and others regarding prices, production, shipments, varieties and grades of fruit, methods and time of sale, and returns. Part of the material presented refers to the region as a whole and part to individual States. The market outlets—local, in neighboring States, and foreign, the prices received in different markets and for different varieties of apples, factors affecting prices, and marketing—supply, variety, grades, time of sale, methods of sale, type of container, etc., are discussed.

Local market requirements of agricultural products in Aroostook County, Maine, C. H. MERCHANT and B. T. SMITH (*Maine Sta. Bul. 355* (*1930*), *pp. 89–106, figs. 5*).—This report is based on 127 invoice records and 71 estimate records for the year ended May 31, 1926, obtained through personal visits to retail stores (exclusive of chain stores), hotels, camps, and bakeries. The physical conditions, population, agriculture, transportation facilities, and the distribution of agricultural commodities in the county are described. Tables are included showing for different fresh fruits and vegetables, flours, livestock feeds, and meats and livestock products the quantities purchased from farmers and from others, the prices paid, and the quantities of the various products it would be practical for the farmers to supply.

Farmers supplied 28.85 per cent of the fresh fruits and vegetables, 17.29 per cent of flour and livestock feeds, and 49.5 per cent of the meats and livestock products. It is estimated that only 13.21 per cent of the commodities now supplied by others than farmers could be supplied by farmers.

Olives, H. R. WELLMAN (*California Sta. Bul. 510* (*1931*), *pp. 27, figs. 5*).—Tables and charts are included and discussed showing for periods of years for California the number of olive trees (bearing and nonbearing), production, utilization by canning, shipping fresh or dried and pressing for oil, the pack shipments and carry-over of canned ripe olives, and the prices paid growers for olives, and for the United States the imports of olives and olive oil. Other tables show the acreage and production of olives and olive oil in the leading countries of the world.

Crops and Markets, [March, 1931] (*U. S. Dept. Agr., Crops and Markets, 8* (*1931*), *No. 3, pp. 81–120, figs. 3*).—Tables, graphs, reports, summaries, and notes of the usual type are included, together with tables showing the farm stocks of corn, barley, and oats on March 1, 1931, the percentage of the 1930 crop shipped out of the county where grown, percentage of the 1930 corn crop of merchantable quality, the movement of population to and from farms during 1930 and the estimated farm population, January 1, 1931, and the monthly average price, 1920–1929, of refined beeswax at Chicago. The farm population is estimated at 27,430,000, an increase for the first time in 10 years.

AGRICULTURAL AND HOME ECONOMICS EDUCATION

A history of South Dakota State College, edited by W. H. POWERS (*Brookings: S. Dak. State Col., 1931, pp. [4]+144+[2], pls. 8*).—The subject is dealt with in chapters as follows: The founding, McLouth's aims as an educator, development, the war and after, curricula and other things, experiment and

extension, the college tangible—lands and buildings, student activities, and our graduates.

Workers in subjects pertaining to agriculture in State agricultural colleges and experiment stations, 1930–1931, M. A. Agnew (*U. S. Dept. Agr., Misc. Pub. 100 (1931), pp. IV+152*).—This is the usual annual list (E. S. R., 61, p. 290) showing by subjects the persons engaged in teaching, research, or extension work in agriculture and home economics at the several State agricultural colleges and experiment stations.

[Progress in vocational education] (*Agr. Ed. [Des Moines], 3 (1931), No. 10, pp. 152–156, 158, 159, 161, 164*).—This is a series of short articles by members of the executive staff of the Federal Board for Vocational Education presenting some of the more noticeable trends in their respective fields as follows: Progress in Methods of Teaching, by A. P. Williams (pp. 152, 158); Progress in Subject-Matter for Instruction in Vocational Agriculture, by W. A. Ross (pp. 153, 164); Progress in Teacher Training, by H. B. Swanson (pp. 154, 164); Progress in Supervised Practice, by R. D. Maltby (pp. 155, 164); Progress in Evening and Part-time School, by J. H. Pearson (pp. 155, 159); Progress in Studies and Investigations, by F. W. Lathrop (pp. 156, 161); and Progress in the Negro Schools, by H. O. Sargent (pp. 156, 161).

Extension work in cooperative marketing, B. B. Derrick (*U. S. Dept. Agr. Circ. 159 (1931), pp. 40*).—This circular is based on a study made by the Bureau of Agricultural Economics and the Extension Service. It describes the present scope and marketing activities of county extension agents; the extension work being done in different sections on marketing dairy products, grain, livestock, poultry and eggs, cotton, tobacco, hay, and wool; the purchasing of farm supplies; the educational methods—economic news service, outlook reports, cooperative marketing schools, and cooperative councils—used in assisting cooperative marketing associations; and the value of extension work to cooperative organizations.

FOODS—HUMAN NUTRITION

An apparatus for determining the tenderness of certain canned fruits and vegetables, V. B. Bonney, P. A. Clifford, and H. A. Lepper (*U. S. Dept. Agr. Circ. 164 (1931), pp. 6, figs. 2*).—This apparatus, which was devised in the laboratories of the Food and Drug Administration particularly for judging the tenderness of canned foods in the enforcement of the provisions of the McNary-Mapes amendment to the Federal Food and Drugs Act, may be used "for measuring the force necessary to compress or crush the test piece to a specified fraction of its original diameter or to penetrate completely the test piece with a standard cylindrical rod." The former method has been used successfully on canned peas and the latter on peaches and pears, and it is assumed that the method will be equally applicable to other canned vegetables and fruits.

The apparatus, when assembled for testing the resistance of a canned food to crushing, consists essentially of a metal plunger 0.25 in. in diameter, sliding freely in a closely fitting sleeve. At the upper end of the plunger is a metal disk about 2 in. in diameter which is used as a platform for a flask fitted with a reservoir through which mercury can be run into the flask slowly and uniformly, while at the same time the supply is being replenished continually by a supplementary reservoir above. The lower end of the plunger is attached to a removable metal disk about 1.25 in. in diameter for crushing the test piece, which is placed on a removable plate glass slide resting on a rigid table under the plunger. The end point in the crushing test is a predetermined fraction of the original thickness of the material, this being one-

fourth the thickness in the case of peas. To measure the thickness before and after crushing, a pivoted lever and curved graduated scale have been provided. The short arm of the lever ends in a sensitive contact point so insulated from the plunger mechanism that an electric buzzer sounds only when the point is made to touch the lower surface of the plunger platform.

In operation a single pea is peeled and one cotyledon is placed on the flat surface in contact with the glass slide. The plunger is lowered gradually until it just touches the pea and is then fixed in this position by means of a set screw. The thickness is measured by moving the lever until the buzzer sounds, showing that the short arm has touched the bottom of the platform. The pointer is then brought back along the scale to one-fourth this figure, the set screw holding the plunger is released, and the plunger is lowered by adding mercury to the flask until the buzzer again sounds, when the mercury is at once shut off. The weight required for crushing is that of the flask and mercury plus the weight of the plunger.

When the tenderness of such materials as canned pears or peaches is to be determined by the penetration method, the lower disk of the plunger is replaced by a cylindrical rod $\frac{5}{32}$ in. in diameter fastened firmly to the plunger. The rod is placed upon the surface of a section of the fruit held in an appropriate container and the mercury is allowed to run into the flask as before until the rod perforates the fruit. In this case no measurements of thickness are required.

Concerning the reliability of this method as compared with subjective methods of testing for tenderness, it is stated that "repeated tests have demonstrated that this device reflects the consensus of opinion of expert graders on canned peas, at or near the border line between the present commercial concepts of what constitutes a standard and a substandard canned pea, so far as tenderness is concerned."

Cooking winter vegetables at high altitudes (*Wyoming Sta. Rpt. 1930, p. 25*).—Data are given on the time required to cook different vegetables at the station (altitude approximately 7,200 ft.) as compared with previously reported data from the University of Chicago, the methods of cooking including boiling, steaming, and baking.

Baking with Wyoming flour (*Wyoming Sta. Rpt. 1930, p. 25*).—In this progress report (E. S. R., 63, p. 189), it is stated that storage for seven months appeared to improve the baking qualities of flour made from Wyoming hard wheat. Determinations of the moisture content of flour in storage showed that whether the initial content was high or low it gradually came into equilibrium with the relative humidity of the storage room, changing slightly thereafter with changes in the humidity.

Studies in home canning methods (*Indiana Sta. Rpt. 1930, pp. 51, 52*).—In this progress report on oven canning, a few data are given on the rate of heat penetration to the center of quart jars of water processed in the oven and in a water bath, respectively. It was found that if the initial temperature of the water was 68° F. (20° C.) and the oven had been preheated with a heat regulator set for 275° F., from 95 to 110 minutes were required for the contents of the jar to reach boiling temperature as compared with from 20 to 25 minutes in a bath of vigorously boiling water. When the initial temperature of the contents of the jar was 158° F. the corresponding times required in the oven and water bath were from 50 to 55 and from 15 to 18 minutes, respectively.

Work of preserving fruits and vegetables by freezing (*Georgia Sta. Rpt. 1930, pp. 29–32*).—This progress report (E. S. R., 63, p. 189) lists the kinds and varieties of fruits, vegetables, and juices frozen at the station during the past five years in order of adaptability to freezing thus far developed, the media

in which the fruits and vegetables were frozen, and the kinds and sizes of containers used.

Adequate diets for families with limited incomes, H. K. STIEBELING and M. BIRDSEYE (*U. S. Dept. Agr., Misc. Pub. 113 (1931), pp. 16*).—"This publication brings together information to help nutrition workers offer sound counsel to those who must provide adequate food for their families with limited resources, and to assist relief workers charged with distributing food supplies in times of emergency."

On account of wide differences in available foods and in the food customs of people in various sections of the country two types of low cost diets are considered, the first for general use in sections of the country in which a wide variety of foods is used in normal times and the second for use in areas where pellagra is prevalent and where the diet in times of stress consists mainly of salt pork, corn meal, and molasses. The suggestions for low cost diets for general use include a family food guide, tables for low cost weekly food supplies for individuals of various ages and for families of given composition, together with equivalent weights and measures of selected food materials, and typical breakfast, dinner, and supper menus. For use in areas in which pellagra is prevalent, the information given includes an emergency food guide, a suggested minimum cost weekly food supply, a list of foods considered to be rich in pellagra-preventive factor, with daily and weekly allowances, and a discussion of the cause, symptoms, and cure of pellagra.

The specific recommendations for the two types of low cost diets are followed by a general discussion, applicable to both groups, of the food requirements of the family group, the value of various types of food in the diet, and the nutritive value of selected food materials.

Manganese in relation to nutrition, M. B. RICHARDS (*Biochem. Jour., 24 (1930), No. 5, pp. 1572–1590*).—Data obtained by the method previously noted (E. S. R., 64, p. 802) are reported on the manganese content of various materials, including the reproductive organs of plants and eggs at various stages of development, vegetable and animal foodstuffs, and various organs of the pig, ox, sheep, fowl, and man. More detailed analyses are included of the liver and pancreas of various species and of the effect of different factors upon the manganese content of various organs.

The question of the possible significance of manganese in plant and animal life is discussed on the basis of these data and the literature on the subject with the conclusion that manganese may be regarded as an essential element for the development of the plant, and that while soil conditions may have some influence in determining manganese absorption by the plant, samples of the same foodstuffs from different sources show approximately the same content of manganese.

Concerning the significance of manganese in animal nutrition, it is thought that although direct proof of its indispensability for normal growth and development has not been furnished, "the steady increase of manganese in the developing egg, the invariable presence of the element in such tissues as the reproductive organs, and the constancy of the amount not only in these organs but also in those most closely connected with the processes of assimilation (a constancy which is fairly well maintained when large amounts of manganese salts are added to the diet) are facts which suggest that manganese is no accidental constitutent of the organism, but may have some intimate relationship to the vital processes."

Vitamin content of common foods (*Georgia Sta. Rpt. 1930, pp. 36, 37*).—This progress report (E. S. R., 63, p. 192) contains further data on the vitamin content of collards and preliminary data on frozen peaches.

The vitamin A content of collards proved higher than anticipated from the preliminary tests. An amount of 0.02 gm. daily of either the raw or cooked greens gave average gains of slightly more than the standard 25 gm. in the 8-week experimental period. Incomplete data on vitamins B and G indicated that 1 gm. of collards would suffice for the standard gain of 25 gm. in 8 weeks in the B tests. In the G studies with tikitiki as the source of vitamin B, 1 gm. of raw collards daily protected 3 rats against pellagra-like symptoms over a 15-week experimental period, and 1 gm. of collards cooked 2 hours protected 2 out of 3 rats and produced an average gain of 25 gm. in 8 weeks. The unit vitamin C value of collards was estimated to lie between 0.2 and 0.5 gm. for raw collards and 2 gm. for collards cooked for 2 hours.

Frozen peaches of the Elberta and Hiley varieties stored for 6 or 7 months at a temperature below the freezing point proved very deficient in vitamin C. In preliminary vitamin A studies 2 gm. of Elberta peaches induced more than the standard gain in weight. The Hiley variety appeared less rich in vitamin A and was also low in vitamin B.

Some observations on the behavior of vitamin A in or from primary sources, E. J. QUINN, J. G. HARTLEY, and M. A. DEROW (*Jour. Biol. Chem., 89 (1930), No. 2, pp. 657–663*).—Studies on the stability of vitamin A from plant sources are reported briefly, with the following results:

Finely ground, dried spinach kept in a tightly closed Mason jar exposed to diffused light in the laboratory lost approximately 70 per cent of its vitamin A content after a period of from 12 to 15 months. Similarly dried spinach mixed with rancid butterfat containing no appreciable vitamin A lost under the same conditions more than 80 per cent of its content of vitamin A, the greater part of the destruction taking place after the first 8 weeks.

The vitamin A in dried tomato pulp, carrots, and broccoli was found to be readily soluble in, and extractable by, peanut oil. The vitamin A content of a petroleum ether extract of carrot was readily destroyed by irradiation.

Action and identity of antirachitic vitamin (*Iowa Sta. Rpt. 1930, pp. 55, 56*).—In this progress report (E. S. R., 64, p. 897), it is stated that cholesterol freed from traces of ergosterol can be rendered antirachitic by boiling in carbon tetrachloride with Florida clay, as described by Bills (E. S. R., 55, p. 711), and that the active substance, which is in the carbon tetrachloride solution and not adsorbed on the clay, has the same potency whether refluxed for 2 or 8 hours and its toxicity is less when boiled for 2 hours. As also shown by McDonald and Bills (E. S. R., 64, p. 709), ergosterol treated in the same way is not rendered antirachitic.

Surface tension experiments with aqueous solutions of both cholesterol and ergosterol showed that both of the sterols form interfacial condensed films at very low concentrations in saturated water solutions, cholesterol being soluble in about 250,000 and ergosterol in about 2,000,000 parts of water at 25° C. The ergosterol film on irradiation formed a nonpolar, waxy product which was less attracted to water. This was not the case with cholesterol.

Surface tension measurements of water suspensions of the intestinal media of rachitic rats receiving vitamin D treatment showed that a sudden lowering of about 6 dynes occurred in the colon as the alkalinity approached zero. "This decrease in surface tension bore a fixed relation to the decrease in alkalinity and appears, therefore, to have been caused, not directly by the presence of activated ergosterol but indirectly by the change in reaction induced by the vitamin."

The precise evaluation of light therapy in experimental rickets, J. W. M. BUNKER and R. S. HARRIS (*Amer. Jour. Pub. Health, 20 (1930), No. 12, pp. 1287–1292*).—Attention is called to the fact that most experiments dealing with

the effective range of ultra-violet light in the prevention and cure of rickets "have been planned without due regard for the fact that a 'dose' of radiation energy is composed of two factors, intensity and duration." The studies reported were undertaken in an attempt to evaluate the different bands of light from the mercury arc lamp by means of comparisons in which the intensity of the light energy supplied should be the same in every case.

In the beginning of the experimental work difficulty was encountered in inducing rickets in rats on the Steenbock rachitic diet 2965. The chief source of the difficulty was found to lie in the presence of appreciable amounts of vitamin D in freshly ground yellow corn meal. This difficulty was overcome by storing the meal for 6 months before using. In the technic followed, animals from stock on a diet of rather low antirachitic potency were placed at the age of 30 days and weight of 48 to 55 gm. on the Steenbock rachitic diet and kept on this diet for 24 days, with daily irradiations with a standardized dosage of ultra-violet light from a Cooper Hewitt mercury vapor lamp through filters of special glass containing chemical solutions cutting off various wave lengths. The diagnosis of rickets was based on X-ray examinations and line tests on femurs. In the former, low voltage with slow development is recommended as forming sharper shadows. The line test method was modified by holding the split bones overnight in the ice box in 10 per cent formalin and then, after the usual washing and treatment with acetone and silver nitrate, exposing them to ultra-violet light instead of incandescent light.

In experiments conducted on over 800 animals, every animal subjected to the standard irradiation of measured intensity under the bare arc was protected against rickets, while in every other group, excluding first the infra red, then visible light, and then portions of the spectrum down to 3,300 a. u., there was some protection and some failure in protection. The unreliability of these experiments was demonstrated by repeated checks and repetitions. The authors conclude that "in the light of results obtained, it is felt that the rather general belief that antirachitic effect of light in rickets prevention in white rats is confined to the zone of ultra-violet in the neighborhood of 3,000 Å. and that other parts of the spectrum from the mercury arc lamp are without contributory effect, is a belief that is not adequately supported by experimental evidence. It is, in our opinion, still a possibility that the future will show that radiations longer or shorter in wave length than those of the alleged 'vital band' of ultra-violet may assist in the biochemical prosesses of rickets therapy."

The source of excess calcium in hypercalcemia induced by irradiated ergosterol, J. H. Jones, M. Rapoport, and H. L. Hodes (*Jour. Biol. Chem., 89 (1930), No. 2, pp. 647–656, figs. 3*).—Conflicting conclusions concerning the source of calcium in the hypercalcemia produced by excessive doses of irradiated ergosterol are summarized briefly, and experiments on dogs are reported in which a comparison was made of the effects of the administration of large doses of irradiated ergosterol in association with diets practically free from calcium and containing calcium. The former consisted of lactose 43, lard 22, sucrose 33, and cane sugar charcoal 2 per cent, with the addition of the alcoholic extract of 25 gm. of wheat embryo to every 160 gm. of the mixture. This diet, although admittedly incomplete and unbalanced, was considered to furnish sufficient vitamin B (old terminology) to prevent loss of appetite, sufficient energy to prevent excessive destruction of the body tissues, and adequate roughage to insure normal intestinal movements and evacuation.

The dogs on control rations containing about 0.25 per cent calcium invariably developed pronounced hypercalcemia within 2 weeks following the administration of 0.1 cc. of a solution of irradiated ergosterol (1,500 D) per kilogram of body weight per day. The dogs on the calcium-free diet showed only

a slight increase in the concentration of serum calcium in 3 weeks. When calcium was added to the diet at the end of this period, there was a sudden and pronounced increase in the serum calcium.

In addition to these controls, 2 dogs were given the calcium-free diet plus 1 per cent of calcium in the form of calcium gluconate. One of the dogs was given irradiated ergosterol at the beginning and the other was kept on the high calcium diet for 2 weeks before the administration of irradiated ergosterol was begun. In the latter the concentration of serum calcium remained constant until the irradiated ergosterol was administered and then immediately increased, while the other showed an increase from the beginning of the experiment.

These data are thought to indicate that the source of the excess calcium in irradiated ergosterol hypercalcemia is the food and not the body tissue.

Artificial sunlight, M. Luckiesh (*New York: D. Van Nostrand Co., 1930, pp. [7]+254, pls. 9, figs. 65*).—The general subject of this treatise is dual-purpose lighting, in which radiant energy for health is combined with light for vision. Throughout the volume the physilogical effects of radiant energy have been coordinated with the physics of the subject in the hope that the data and discussions "will be helpful to physiologists, biologists, the medical profession, and others primarily interested in health maintenance as well as to physicists, engineers, and others interested primarily in lighting the indoor world."

Of particular interest from the health point of view are the chapters entitled the sun's beneficence, solar radiation, effects of spectral energy, reflection of ultra-violet radiation, transmitting media, infrared radiation, and incandescent solids. In the chapter entitled electric arcs are discussed several types of arc lights for emitting ultra-violet radiation, including the sunlight Type S–1 lamp consisting of a mercury are combined with incandescent tungsten. Data on the therapeutic value of this lamp are summarized, including the studies of Gerstenberger and Russell (E. S. R., 63, p. 496). In the final chapter, utilization of artificial sunlight, various dual-purpose lighting fixtures are described and illustrated, with a discussion of some of the advantages of artificial over natural lighting.

TEXTILES AND CLOTHING

[Wool investigations in Wyoming] (*Wyoming Sta. Rpt. 1930, pp. 28–30*).—Of 85 pairs of duplicate samples scoured for wool shrinkage, 59 pairs differed from each other by less than 2 per cent and 12 of the remainder by less than 3 per cent. Small samples from two large Wyoming clips shrank 66.8 and 60.4 per cent, while large samples, i. e., two full bags from the same clips the same day but scoured at the Texas Station shrank 66.1 and 60.6 per cent, respectively. In tests of sheep branding paints, it was demonstrated that several commercial brands of paints will scour out in solutions containing 24 parts of soda per thousand (slightly less than 1 lb. of soda ash to 5 gal. of water) when the temperature of the scouring bath is 120° F. A few paints scoured out when 10 parts per thousand were used at 130° to 140°. Although this scour was stronger than used by most mills, there was no noticeable soda burning at the tips of the wool.

Microscopic and mechanical-technical textile investigations, P. Heermann and A. Herzog (*Mikroskopische und Mechanisch-Technische Textiluntersuchungen. Berlin: Julius Springer, 1931, 3. ed., rev. and enl., pp. VIII+451, figs. 314*).—Published as a revised and enlarged edition of the book of Heermann (E. S. R., 57, p. 795), more than half of this manual is devoted to the microscopy of textile fibers.

HOME MANAGEMENT AND EQUIPMENT

Consumption habits and standards of Iowa farm families (*Iowa Sta. Rpt. 1930, p. 60*).—The analysis of expenditure schedules of approximately 150 farm families in three sections of the State showed that the percentages of total living going for various items were quite similar in the different sections. The average farm living value was $1,624.95. Approximately 15 per cent of the total was spent for housing, 40 for food, 10 for clothing, 5 for fuel and lights, and 30 per cent for sundries. The farm furnished about 60 per cent of the food, 30 or more of the fuel, and all of the housing, the total amounting to over 40 per cent of the total cost of living.

Almost all of the families had automobiles, slightly over one-half radios and nearly as many pianos, over one-fourth electricity, and slightly less water piped to the house. One-eighth of the homes had inside toilets, 9 out of 10 of the families telephones and sewing machines, and 8 out of 10 washing machines of some sort.

According to the prevailing standards, the diets in all sections were of high energy value and the consumption of milk was relatively high. The chief deficiency appeared to be in green vegetables and fruits during parts of the year.

[Use of electricity in cooking] (*Iowa Sta. Rpt. 1930, pp. 59, 60*).—This progress report describes the apparatus used in the process of cooking with heat generated by the resistance of the food to the passage of an alternating electric current through it (E. S. R., 61, p. 394). The equipment consists of an earthenware casserole or jar, two stainless steel disc electrodes, and a bakelite base at one end of which is mounted a hollow steel post carrying an adjustable U-shaped arm. The bottom electrode is attached to a threaded stainless steel post sealed in the bottom of the jar and the top electrode to the adjustable arm by means of which it can be lowered to any desired depth in the jar. A bakelite cover plate is attached to the top electrode to safeguard the operator from danger. Proper wiring is provided to bring the 110-volt, 60-cycle, alternating current to the electrodes.

In operation, the material to be cooked is placed in the container on the bottom electrode and the top electrode is dropped until in contact with the material. Meats and certain vegetables and fruits such as tomatoes and juicy apples may be cooked without water, but with most vegetables it has been found advisable to add enough water to submerge completely the top electrode after the container is filled and the electrode adjusted. Most fruits can be cooked without water, but, on account of the rapidity of cooking, if sugar is desired it is added in the form of sugar sirup. When the current is turned on the materials are cooked with great rapidity. Fruit cooked by this process and canned in glass jars has been found to keep well if the jars are properly sealed.

Study of ovens used for domestic cooking purposes (*Indiana Sta. Rpt. 1930, p. 53, fig. 1*).—In a study of the insulated oven of an electric stove it was found that radiation losses per 1,000 sq. in. inside surface were 86 watts at 115° F. and 519 watts at 640°. Readings taken by means of thermocouples in different locations indicated considerable variation in temperatures within the oven. The greatest loss of heat was at the back of the oven. The temperature of the top of the oven near the back was higher than that near the front of the oven. Thermal efficiency tests showed the percentage of efficiency to be 32 per cent, or considerably lower than that obtained with similar tests made of surface burners of electric stoves.

Studies comparing the amount of fuel required for cooking a meal with the use of an insulated oven of a gas stove and with an uninsulated oven showed an appreciable saving of fuel with the use of the insulated oven. The use of a two-burner portable oven required a little less fuel for cooking the meal than did the uninsulated built-in oven, and with a one-burner portable oven the fuel required was appreciably less than with either the use of the two-burner portable oven or with the uninsulated built-in oven.

The efficiency of the home laundry plant, E. H. ROBERTS (*Washington Col. Sta. Bul. 248 (1931), pp. 39, figs. 3*).—This publication, based upon a typewritten technical report available only by loan from the college library of the State College of Washington, describes the ideal home laundry plant in terms of the requirements for the two principal processes, washing and ironing, and discusses the cost of operation of such a plant in comparison with sending the family washing to a power laundry. A brief discussion is also included of the relative health aspects of home and power laundry methods. The original data presented include a comparison of the relative cleaning abilities of four types of power washing machines—the agitator, vacuum cup, cylinder, and oscillator; a summary of data obtained in a survey of the distribution of washing equipment in 388 farm homes and 184 town homes in the State; tabulated data on the alkaline rating, purchase price and actual cost per ounce, and the calculated amount and cost to form permanent suds in 10 gal. of hard water of 20 laundry soaps sold in the State; reports on the consumption of electricity and operating costs of specific irons and ironers and on the average times required for ironing various articles with the electric iron and ironer; and comparative cost data on home laundry and power laundry services alone or combined.

The essential equipment, materials, and methods for the efficient home laundry are summarized as follows: "The efficient home laundry contains the best equipment and most modern conveniences it is possible to secure, due consideration having been given to the size of the family pocketbook. It should include running water, means of heating the water, stationary tubs, electric washer, wringer, ironing board and irons, all arranged to save steps and energy. The efficient home laundry includes the use of the following materials: (1) Softened water, (2) neutral soaps for silks, rayons, and wools, neutral or slightly alkaline soaps for cottons and linens, (3) bleaching, only as a separate process, (4) no bluing, since several thorough rinses should produce the desired whiteness, (5) the correct stiffening agent for each fabric, (6) correct soaking and washing times and temperatures for the various textiles. The efficient home method includes a 5- to 10-minute soaking in softened water, 15 minutes of agitation in hot suds in the washer, a hot rinse, and a cold rinse, also partial drying and ironing at the correct ironing temperatures."

The conclusion drawn concerning the question of doing the laundry at home or sending it to the power laundry is that "when the cost of equipment, interest, depreciation, and materials are considered, and when the housewife's time is figured at reasonable labor rates, the costs of doing the laundry at home are only a little less than the costs of sending the washing to the power laundry. Sending to the laundry may well be considered when the standards of the local laundry are high and the income level of the farmer permits."

MISCELLANEOUS

Forty-third Annual Report [of Georgia Station], 1930, H. P. STUCKEY (*Georgia Sta. Rpt. 1930, pp. 50, figs. 8*).—This contains the organization list, a

report by the director of the station on its work during the year, and a financial statement for the fiscal year ended June 30, 1930. The experimental work reported is for the most part abstracted elsewhere in this issue.

Forty-third Annual Report of [Indiana Station], 1930, J. H. Skinner and H. J. Reed (*Indiana Sta. Rpt. 1930, pp. 116, figs. 42*).—This contains the organization list, a report of the director summarizing the activities of the station, and a financial statement for the Federal funds for the fiscal year ended June 30, 1930, and for the remaining funds for the fiscal year ended September 30, 1930. The experimental work reported and not previously noted is for the most part abstracted elsewhere in this issue.

Annual Report [of Iowa Station], 1930, C. F. Curtiss and W. H. Stevenson (*Iowa Sta. Rpt. 1930, pp. 64*).—This contains a report on the work of the station, including a financial statement for the fiscal year ended June 30, 1930. The experimental work recorded not previously noted is for the most part abstracted elsewhere in this issue.

Forty-second Annual Report of the [Michigan Station, 1929] (*Michigan Sta. Rpt. 1929, pp. 145–203, figs. 13*).—This contains reports of the heads of departments on the work of the station during the year, the experimental features of which are for the most part abstracted elsewhere in this issue. Analyses of vinegar are also included (p. 167).

Fifty-third Annual Report of the North Carolina Agricultural Experiment Station, [1930], R. Y. Winters et al. (*North Carolina Sta. Rpt. 1930, pp. 159, figs. 37*).—This contains the organization list, a report of the director and heads of departments, and a financial statement for the fiscal year ended June 30, 1930. The experimental work not previously reported is for the most part abstracted in this issue.

Fortieth Annual Report of [Wyoming Station, 1930], J. A. Hill (*Wyoming Sta. Rpt. 1930, pp. 52*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1930, a report of the director on the work of the station, and meteorological observations by F. E. Hepner noted on page 111. The experimental work reported is for the most part abstracted elsewhere in this issue.

Report of the institutes, stations, and other institutions for agronomic research in Czechoslovakia, 1929 [trans. title], edited by J. Stádník (*Výroč. Zpr. Výzkumn. Úst. Zeměděl. Repub. Československ.* (*Ann. Insts. Recherches Agron. Répub. Tchécoslov.*), *6 (1930), pp. VIII+576+62+18+228+7+66, pl. 1, figs. 11*).—To this comprehensive account of the activities of these institutions are appended summaries in French (pp. 1–32) and German (pp. 33–66). A map showing the location of the various institutions and their principal lines of work is included.

The Swedish Central Agricultural Experiment Station (*Stockholm: Swedish Cent. Agr. Expt. Sta., 1930, pp. 56, figs. 6*).—The history and work of this institution are briefly discussed.

NOTES

Alabama College and Station.—On May 18, as a part of the commencement exercises, a portrait was presented of the late Dr. B. B. Ross, associated with the chemistry work of the institution from 1884 to 1887 and continuously from 1893 until his death on April 4, 1930. The new chemical laboratory, completed and dedicated soon after his death, has been named in his honor the Ross Chemical Laboratory. He had been dean of the College of Agricultural Sciences, dean of the School of Chemistry and Pharmacy, for 37 years State chemist, and twice for brief periods acting president of the college. In these capacities he had been directly responsible for the development and upbuilding of the chemical work of the institution. He was also widely known for his activities in various organizations, serving as president of the Association of Official Agricultural Chemists in 1895–96 and the Association of Feed Control Officials of the United States in 1926–27.

Alaska Stations.—Clifford Cordy has been appointed assistant horticulturist beginning May 1.

California Station.—Arthur H. Hoffman, agricultural engineer since 1919, died May 19 at the age of 57 years. He was a native of Iowa and educated at the Iowa Wesleyan and Iowa State Colleges. He had also been engaged in teaching and research at the Iowa State College, Rutgers University, and the New Mexico College.

Prof. Hoffman's most outstanding work was in connection with air cleaners and the effectiveness of oil filters for internal combustion engines. He was the first to standardize methods of testing, and his advice was widely sought by the automotive and tractor industries. He also conducted extensive studies on methods of orchard heating and had experimental work under way to determine ways and means of smoke abatement from citrus orchard heating. For a number of years he was a member of the council of the American Society of Agricultural Engineers.

Idaho University and Station.—Dr. C. W. Hungerford, professor of plant pathology, plant pathologist, assistant dean of the College of Agriculture, and vice director of the station, has been appointed dean of the Graduate School, effective June 1.

Illinois University and Station.—During the installation of Dr. Harry Woodburn Chase as president of the university on May 1, the honorary degree of doctor of laws was conferred upon Dean Emeritus Eugene Davenport, "scientist, educator, and author, pioneer in experimental work for the betterment of agriculture, devoted administrator and guardian of the university's welfare, beloved among his colleagues."

"Trained in practical and scientific agriculture," as Dean Mumford's address of presentation pointed out, "he was called to the university in 1895 to join that group of distinguished men who were to exert such an influence upon the destiny of the institution. Here he entered upon an ambitious and aggressive program as dean of the College of Agriculture and later as director of the agricultural experiment station, reorganizing the work of the college and winning such support for its program that what had been one of the weakest depart-

ments of the institution achieved a prominent place in the university. Later, the opportunity for advisory war service, the vice presidency of the university, and his retirement to an active writing career from his farm home have occupied his high talents. With vision and interests reaching beyond the field of agriculture, he has been instrumental in guiding educational policies along lines consistent with the purposes and ideals of a democracy."

Maine Station.—Dr. Fred Griffee, biologist and head of the biology department since 1928, and for some time assistant director, has been appointed director. He has been succeeded as head of the department of biology by Dr. W. F. Dove. Russell M. Bailey has been appointed associate biologist and will have charge of the investigations in horticulture carried on at Highmoor Farm. Other appointments include Lolie Smith as associate home economist and G. W. Simpson as assistant entomologist, the latter for studies of problems of disease-free seed stocks of potatoes in Aroostook County.

New Hampshire University and Station.—Philip R. Lowry, assistant professor of economic entomology and assistant entomologist since 1921 died April 30 at the age of 35 years. He was a native of Ohio, receiving the B. S. degree from Ohio State University in 1920 and the M. S. degree a year later. He was the author of a bulletin on the stalk borer, published in 1927. Some of his most recent investigations had been with insecticides.

New Jersey Stations.—J. Paul Jennings, assistant in poultry husbandry, has resigned. Robert H. Daines has been appointed research assistant in plant pathology.

Cornell University and Station.—Excavation was started about May 1 for a new building to house the department of agricultural economics and farm management and the department of rural social organization. This building will be 280 ft. long and four stories high and will cost nearly $600,000. Future plans call for a library building to connect it with the plant industry building and making a closed court.

The recent legislature provided $65,000 for the purchase of new foundation breeding animals for the department of animal husbandry. The first additions are to be to the dairy herd.

Dr. A. R. Mann, dean of the Colleges of Agriculture and Home Economics and director of the station, has been named one of a commission of twelve to make an intensive study of foreign missions in the Orient. This study will begin next October and continue for nine months in India, Burma, China, and Japan.

The recent obituary note regarding the late Dean P. A. Fish (E. S. R., 64, p. 499) erroneously stated that he had been editor of the *Journal of the American Medical Association.* The periodical intended was the *Journal of the American Veterinary Medical Association.*

Oregon Station.—G. R. Hoerner, recently appointed plant pathologist in the U. S. D. A. Office of Drug and Related Plants, is to conduct a cooperative investigation of the downy mildew of hops in the Northwestern States and with headquarters at the station.

Virgin Islands Station.—Ulphian C. Loftin has been appointed principal entomologist for six months beginning May 1. Norris N. Nichols has been appointed associate animal husbandman and dairyman from the same date.

West Virginia University and Station.—G. A. Bowling, extension dairy specialist at the Michigan College, has been appointed assistant professor of dairy husbandry and assistant dairy husbandman vice K. S. Morrow, resigned to become associate extension dairyman at Rutgers University.

EXPERIMENT STATION RECORD

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RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

A study of some of the chemical characteristics and the absorption spectrum of cystine, M. L. FOSTER, G. A. ANSLOW, and D. BARNES (*Jour. Biol. Chem., 89 (1930), No. 2, pp. 665–673, figs. 7*).—In a study from Smith College of the crystallization of cystine, data indicating "a direct ratio between the concentration of the cystine and the pH value at which it crystallizes, or is precipitated," were secured. Further, "since the absorption curves for cystine show only continuous absorption we conclude that the structure of cystine is that usually assumed, a straight chain, and not a ring as proposed by Ward. From the magnitude of the molecular absorption coefficient we have determined the degree of dissociation, produced by light of different wave-lengths, which ranges from 10^{-8} to 10^{-4}, the former value agreeing with that of Sano.

"We have also calculated the dissociation energy which is approximately 4.9 erg per molecule, or 70,800 calories per gram molecule."

Studies on the spontaneous oxidation of cysteine.—I, The preparation of iron-free cystine and cysteine hydrochlorides, E. G. GERWE (*Jour. Biol. Chem., 91 (1931), No. 1, pp. 57–62*).—A very high degree of purification of cystine and of cysteine was secured by dissolving the hydrochlorides of the respective amino acids in the minimal quantity of distilled water in a quartz flask, chilling the solution, and saturating it with hydrochloric acid gas to precipitate the amino acid hydrochloride. With respect to the purification of cysteine it was observed that "for an especially pure sample five or six crystallizations are sufficient, while samples less pure will require more; but since the purification does not involve spontaneous crystallizations, which require standing over a considerable number of hours or even days," the required elimination of iron compounds could be effected in a few hours. "Small traces of copper which may have been present in the crude preparation were completely removed long before the iron in the early crystallizations. The purification involves a loss of 50 to 90 per cent." The purification was so complete, however, that the tests made indicated "that a 20-mg. sample, the quantity commonly used in the ordinary oxidation experiment . . . contained less than 0.000000001 gm. of iron."

Arsenic derivatives of cysteine, J. M. JOHNSON and C. VOEGTLIN (*Jour. Biol. Chem., 89 (1930), No. 1, pp. 27–31*).—To throw further light upon the chemistry of the protection against the toxic action of arsenic compounds afforded by reduced glutathione and by certain other sulfhydryl compounds, the authors of this contribution from the U. S. Public Health Service examined the reaction of 3-amino-4-hydroxyphenylarsenious oxide and of arsenic trichloride with cysteine. From the first-named compound dicysteinyl-3-amino-4-hydroxyphe-

nylarsine was obtained, and from the arsenic trichloride, tricysteinylarsine. Both compounds were obtained in pure crystalline form.

"The ease with which arsenious oxides react with cysteine with the formation of pure crystalline compounds adds further chemical evidence to our theory of the biological action of arsenic."

The preparation and some properties of the crystalline methemoglobin of the horse, M. Levy (*Jour. Biol. Chem., 89 (1930), No. 1, pp. 173–183*).—In a contribution from Harvard University the author describes three methods for the preparation of crystalline methemoglobin from the hemoglobin or oxyhemoglobin of horse blood, together with a solubility study in which it was observed that the solubility of the methemoglobin in phosphate buffers depends, like that of the corresponding oxyhemoglobin, on the ionic strength of the buffer solution. Also, "oxyhemoglobin is shown to be thermodynamically unstable with respect to the formation of methemoglobin and oxygen, and any detectable amount of oxyhemoglobin spontaneously appearing in methemoglobin solutions owes its origin to unknown reducing agents and not to the appearance of an equilibrium with O_2."

Stoichiometrical relations in the reactions between dye, nucleic acid, and gelatin, A. E. Stearn (*Jour. Biol. Chem., 91 (1931), No. 1, pp. 325–331, figs. 2*).—"Conductometric titrations of methyl violet with sodium nucleate and sodium gelatinate were made; definite equivalence values were found which were independent of the direction of the titration; the equivalent weight of nucleic acid from these data is in good agreement with that calculated from Levene's formula," according to the communication from the University of Missouri here noted; and the binding power of gelatin for basic dye was found to agree well with results previously reported. "The results indicate combination of dye with nucleic acid or with gelatin in stoichiometric proportions."

Potentiometric study of pyocyanine, E. Friedheim and L. Michaelis (*Jour. Biol. Chem., 91 (1931), No. 1, pp. 355–368, figs. 7*).—The blue pigment of *Bacillus pyocyaneus* was found, at The Rockefeller Institute for Medical Research, to be reversibly oxidizable and reducible. In ranges of pH greater than 6 it behaved entirely as a reversible dye of a quinoid structure. The slope of the titration curve indicated that 1 molecule of the dye combines with 2 H atoms simultaneously. At pH ranges less than 6 the titration curves showed a different shape, "which can be interpreted by the assumption that the 2 H atoms are accepted in two separate steps." The existence of these two steps of reduction was confirmed by the fact that in acid reaction the color, on reduction, changed in two different steps, red to green to colorless, whereas at alkaline reaction the color change took place in one step, blue to colorless. The normal potentials of the dye at various pH are summarized. At about pH 7 the potential range of this dye was shown to lie between that of methylene blue and that of indigo tetrasulfonate.

On rabbit liver glycogen and its preparation, M. Sahyun and C. L. Alsberg (*Jour. Biol. Chem., 89 (1930), No. 1, pp. 33–39*).—Report is made from the Department of Chemistry and the Food Research Institute of Stanford University of a method for the extraction of glycogen from fresh livers by grinding in and extracting with a 3 per cent aqueous solution of trichloroacetic acid.

Glycogen prepared by this method was found to contain between 0.20 and 0.18 per cent of ash, 0.032 per cent of phosphorus as P_2O_5, and traces of calcium and iron. Upon hydrolysis, the computed value of this glycogen was from 96.4 to 99.6 per cent of the theoretical. Glycogen is very easily altered by heating to 105°. Some of the properties of such a glycogen are described.

The unsaponifiable lipids of lettuce.—I, Carotene, H. S. Olcovich and H. A. Mattill (*Jour. Biol. Chem., 91 (1931), No. 1, pp. 105–117, figs. 4*).—Crystalline carotene in the hexagonal system was obtained from the unsaponifiable lipids of lettuce leaves. It was observed that "the fading of the crystals at elevated temperature is not an oxidation." Carotene solutions may be bleached by heat, ultra-violet light, and by the presence of autoxidizable fats. The presence of hydroquinone delays for a variable length of time the bleaching of carotene solutions by any of the above mechanisms. Hydroquinone protects ethyl laurate solutions of carotene apparently indefinitely. Such solutions are satisfactory for physiological studies. In autoxidizable mixtures, carotene is an active prooxidant. This property is unique in a hydrocarbon.

"The physiological activity of carotene as vitamin A is confirmed; under widely differing conditions, the growth induced by feeding carotene seems to be directly proportional to the amount fed; 0.005 mg. permits an increment of 3 to 5 gm. in the weight of rats deprived of vitamin A."

***p*-Aminophenylguanidine hydroiodide,** C. E. Braun (*Jour. Biol. Chem., 89 (1930), No. 1, pp. 97–108, figs. 2*).—This contribution from the University of Vermont reports the experimental detail of a highly satisfactory synthesis of S-methylisothiourea hydroiodide from thiourea and methyliodide, and the condensation of the first-named derivative with *p*-phenylenediamine (1) in absolute alcohol solution and (2) in aqueous solution. Procedure (2) is preferred by reason of the higher yield (from alcohol solution 35 per cent, from water solution 54 per cent of that theoretically possible). Methyl mercaptan was given off during the condensation, which is accordingly represented as consisting in the elimination of the methsulfyl group of the thiourea in combination with one of the 3-amino hydrogen atoms of the diamine.

With respect to the physiological properties of the compounds synthesized, attention is drawn to the fact that "*p*-aminophenylguanidine hydroiodide has been shown to produce without noticeable toxic symptoms a hypoglycemia when subcutaneously administered, without the appearance of hyperglycemia as is usually experienced with synthalin types."

A new synthesis of aspartic acid, M. S. Dunn and B. W. Smart (*Jour. Biol. Chem., 89 (1930), No. 1, pp. 41–50, figs. 5*).—Having established that in the preparation of the sodium salt of phthalimidomalonic ester "dry toluene was . . . an ideal medium for this purpose, [and that] the sodium becomes molten in the boiling fluid and quickly reacts to form from 80 to 90 per cent yield of light yellow product which, without further purification, contains the theoretical quantity of nitrogen," the authors of this contribution from the University of California proceed to experiments showing that "with an 8 : 1 molal ratio of chloroacetic ester and sodium phthalimidomalonic ester the addition product, ethane-α-phthalimido-α, α, β-tricarboxylic acid triethyl ester . . . was formed as a viscous dark oil. The reaction was complete in 1¾ hours as shown by Volhard analyses of the liberated chloride ions. . . . After purification and drying a 92 per cent yield of product containing almost the theoretical amount of nitrogen was obtained. Aspartic acid . . . was obtained by the hydrolysis of this oil." The yield was 33 per cent. A product "thought to be glycine" was also isolated from the reaction mixture.

It is noted also that "sodium phthalimidomalonic ester . . . has been found to react readily with various organic halogen compounds, but only in the case of chloroacetic ester and trimethylene bromide were stable addition products formed."

***Quantitative analytical study of the simultaneous production of thiol* acids (R-S-H) and sulfonic acids (R-SO_3-H) from dithio acids (R-S-S-R)**

by silver sulfate, P. W. and D. B. Preisler (*Jour. Biol. Chem., 89 (1930), No. 2, pp. 631–645*).—With a view to ascertaining whether the reduction of cystine in silver sulfate solutions, recently observed by Vickery and Leavenworth (E. S. R., 63, p. 309), "was a general reaction for other dithio acids (R-S-S-R), and to obtain information regarding the mechanism of this unusual behavior, the reaction between silver sulfate and various dithio acids was subjected to a detailed study" at the University of Pennsylvania Medical School.

"Reducing substances, capable of being oxidized by iodine, result when dithiodiglycolic acid, dithiodilactic acid, cystine, or dithiodihydracrylic acid are allowed to react with silver sulfate solutions. Quantitative analytical experiments have shown that for dithiodihydracrylic acid the reaction occurs essentially quantitatively according to the following equation:

$$3\ NaOOC \cdot CH_2 \cdot CH_2 \cdot S \cdot S \cdot CH_2 \cdot CH_2 \cdot COONa + 5\ Ag_2SO_4 + 3\ H_2O =$$
$$5\ AgOOC \cdot CH_2 \cdot CH_2 \cdot SAg + NaOOC \cdot CH_2 \cdot CH_2 \cdot SO_3H + 5\ NaHSO_4.$$

"The chemical and biological significance of the reaction is discussed."

Oxidation-reduction potentials of certain sulfhydryl compounds, E. K. Fischer (*Jour. Biol. Chem., 89 (1930), No. 2, pp. 753–763, fig. 1*).—The sulfhydryl compounds thioglycollic acid, monothioethylene glycol, and α-hydroxy-β-sulfhydryl propionic acid, have been subjected, in the work reported in this contribution from the University of Wisconsin, to an electrochemical study. It is shown that the observed potentials in the oxidation of these sulfhydryl compounds "depend not only upon the presence of the reduced form and the hydrogen-ion concentration of the solution, but also upon the presence of an oxidized form, presumably an intermediate of unknown chemical composition. The constancy of the calculated apparent normal oxidation potential indicates that the chief factor in determining the reducing level of the compounds studied is the sulfhydryl group."

Rosinduline as oxidation-reduction indicator, L. Michaelis (*Jour. Biol. Chem., 91 (1931), No. 1, pp. 369–372, fig. 1*).—Rosinduline is recommended in this contribution from The Rockefeller Institute for Medical Research as an indicator for oxidation-reduction potential in a very negative potential range. Its normal potential at 30° C. referred to the normal hydrogen electrode, was found to be for pH 5, −0.161; for pH 6, −0.221; for pH 7, −0.281; for pH 8, −0.340; for pH 9, −0.395; for pH 10, −0.438; and for pH 11, −0.480 volts.

Potentiometric studies on complex iron systems, L. Michaelis and E. Friedheim (*Jour. Biol. Chem., 91 (1931), No. 1, pp. 343–353, figs. 2*).—Following a brief discussion of the theoretical considerations bearing upon the oxidation-reduction potentials of solutions containing ferrous and ferric ions, the authors of this contribution from The Rockefeller Institute for Medical Research present and discuss data leading to conclusions thus indicated:

"The normal potential range of ferro-ferri systems may lie between very wide limits, from +0.7 to −0.25 volts, according to the chemical nature of the complex-forming anion. The dependence of such a potential on pH is very small in some cases, but extremely great in others. It is negligible for ferrocyanide, and over a certain range of pH also for oxalate and for pyrophosphate. It is extremely great for acetate, salicylate, malonate, indeed for all such complexes in which the affinity of iron for the complex-forming anion is comparable to that of the hydroxyl ion. In agreement herewith, complexes of this kind are stable only in slightly acid solution, whereas in alkaline solution precipitation of iron hydroxide or insoluble basic salts occurs. These curves can, therefore, be traced only to a pH 5 or so.

"On comparing oxalate, malonate, and succinate the difference in the behavior of these representatives of a homologous series is striking. In oxalate the iron

atom is part of a five-membered ring, in malonate a six-membered, and in succinate a seven-membered ring. Accordingly, the stability of the complex with increasing pH and the potential range of the complex is widely different in these three cases."

The chemical study of bacteria: The presence of *d*-mannose and *d*-arabinose in a complex carbohydrate isolated from the culture medium after the growth of tubercle bacilli, A. G. RENFREW (*Jour. Biol. Chem., 89 (1930), No. 2, pp. 619–626*).—In a contribution from Yale University experiments are reported in which a carbohydrate fraction, the crude preparation of which gave precipitin tests with immune serum, was isolated from synthetic media on which tubercle bacilli had been cultured. "*d*-Mannose and *d*-arabinose have been identified among the products obtained by acid hydrolysis of the carbohydrate. Some properties of *d*-arabinose benzylphenylhydrazone have been noted."

Antioxidants and the autoxidation of fats, H. A. MATTILL (*Jour. Biol. Chem., 90 (1931), No. 1, pp. 141–151*).—"To secure information on the chemical nature of the antioxygenic substances that are found in natural oils and that prevent the autoxidative destruction of fat-soluble vitamins, a series of hydroxy aromatic compounds was tested for their capacity, when used in a quantity of 0.02 per cent, to prolong the thermal oxidation induction period of a standard mixture of lard and cod-liver oil. The observations indicate that antioxygenic capacity of phenols resides in two hydroxyl groups in the ortho or para configuration; when these are in the meta position the compound is inactive. The hydroxyls are ineffective unless attached directly to the ring; the fully hydroxylated inosite is inactive. In the naphthols one hydroxyl group is sufficient and in keeping with its accepted behavior, α-naphthol has the character of an ortho compound and is much more effective, as an antioxidant, than β-naphthol; quinone is effective and β-naphthoquinone is even more so, but the α form is entirely inactive."

The relation of these facts to recent theories concerning the electronic structure of the benzene ring and autoxidation is discussed briefly, and the probable significance of pro- and antioxygenic substances in the physiology of the vitamins is suggested. Attention is called to recent observations indicating that the functions of the fat-soluble vitamins are not entirely known or as yet properly allocated, and that the "progress in the solution of these problems depends on the successful segregation of the factors concerned, among them probably pro- and antioxidants."

On the chemical nature of vitamin D, E. TAKAMIYA (*Jour. Dept. Agr., Kyushu Imp. Univ., 3 (1930), No. 1, pp. 27, pl. 1*).—Data are presented in support of the theory that vitamin D is imperfectly ozonized ergosterol. The evidence is essentially as follows:

Vegetable oils after irradiation were less readily hydrolyzed by castor-bean lipase than the original oils, the decrease in enzymic-hydrolysis velocity of the oil being directly proportional to the length of time of irradiation. The irradiated oils also had a higher acid value and viscosity and lower iodine value than the nonirradiated. These changes were similar to those produced in the same oils by the action of ozone. Similar results were obtained with cholesterol by the action of ozone and by irradiation as regards photoactivity and color reactions.

Rachitic rats were cured by exposure to ozone for a few minutes each day while still on the rachitic diet (McCollum 3143). Ergosterol under suitable treatment with ozone acquired antirachitic properties. As in the case of the activation of ergosterol by irradiation, a point of maximum potency was

reached, followed by a decrease in potency until the product became entirely inactive.

A method for the determination of the freezing point depression of aqueous solutions, particularly those containing protein, W. C. Stadie and F. W. Sunderman (*Jour. Biol. Chem., 91 (1931), No. 1, pp. 217–226, fig. 1*).—In the apparatus and method here reported, "the solution in a cooling vessel is cooled to a temperature within less than 0.1° of its freezing point. . . . It is then transferred to a second (equilibrium) vessel, which contains several small pieces of ice which (as well as the equilibrium vessel, thermometer, and stirrer) have also been precooled to the approximate freezing temperature, and the final exact equilibrium is rapidly attained. The precooling of the solution, ice, and equilibrium vessel, and the fact that the latent heat of fusion of ice is high, minimizes the melting of ice necessary to attain equilibrium so that the dilution of the original solution when it is transferred to the equilibrium vessel is negligible for most purposes. The whole apparatus is immersed in a bath adjusted by the addition of brine to within less than 0.1° of the freezing point so that supercooling is impossible."

The disadvantages of the earlier methods, summarized in the introductory discussion, "are overcome with no increase in technical difficulties and within the limits for which the method was designed, employing a Heidenhain thermometer; we estimate conservatively that the method is accurate to within ± 0.001° equivalent to ± 0.6 mM of osmolar concentration."

***Determination of the pH of serum at 38° with the glass electrode and* an improved electron tube potentiometer,** W. C. Stadie, H. O'Brien, and E. P. Laug (*Jour. Biol. Chem., 91 (1931), No. 1, pp. 243–269, figs. 5*).—A modification of the senior author's electron tube potentiometer (E. S. R., 62, p. 607) is described and illustrated, together with a form of the glass electrode found suitable for the determination at 38° C. of the pH of serum. It was found that the modified potentiometric circuit "is very stable, shows practically no drifting of the zero, and has a sensitivity of 10 to 15 mm. of deflection per millivolt. It measures the absolute e. m. f. of glass electrodes to 0.1 millivolt without drawing appreciable current from the cell.

"The behavior of glass cells of the MacInnes type with respect to cell constant and asymmetry potential is discussed. Comparative pH determinations of serum by the hydrogen and glass electrodes are reported. An accuracy of <0.01 pH unit for serum handled with proper technique is obtainable. The time required for blood and serum to give a constant e. m. f. equilibrium in the glass electrode is about 30 seconds, and constant readings may be attained for hours."

The gasometric determination of cysteine and cystine, H. D. Baernstein (*Jour. Biol. Chem., 89 (1930), No. 1, pp. 125–131*).—Report is here made in a contribution from the University of Wisconsin of "a method for the determination of cysteine and cystine . . . which depends upon the reducing properties of the sulfhydryl group when oxidized in acid (2 N) by a solution of iodine in potassium iodide. A known excess of iodine is allowed to react with cysteine, and the excess is determined gasometrically by a hydrazine titration in the apparatus of Van Slyke and Neill. The method is simple, rapid, and accurate to about 4 per cent."

Manometric determination of hemoglobin by the oxygen capacity method, J. Sendroy, Jr. (*Jour. Biol. Chem., 91 (1931), No. 1, pp. 307–323, figs. 4*).—"A rapid technique for determination of hemoglobin in blood by the oxygen-combining capacity method" was made possible, in the investigation here reported from the Hospital of The Rockefeller Institute for Medical

Research, "by diluting the blood with 0.9 per cent sodium chloride solution before aeration. Compared with the former technique . . . in which the blood was aerated in a separate vessel, the present method requires less apparatus, time, and blood. Good results are obtainable with blood samples as small as 0.2 cc."

SOILS—FERTILIZERS

[*Soil investigations at the Carbon County Experiment Farm, Utah, 1927–1930*], I. D. ZOBELL and G. STEWART (*Utah Sta. Bul. 225 (1931), pp. 4–6, 7, 8, 10–12, figs. 5*).—The following soil items are included:

Soil.—The principal soil need indicated by these studies is an increased content of organic matter, the average found being 1.35 per cent. Increase in the humus content of the soil was found to improve tilth, moisture-holding capacity, and, apparently, the germination in the soil of "many of the smaller seeds."

Erosion.—"It is thought that the almost entire lack of any grass or herbaceous plants interspersed with the desert shrubs permits the ready accumulation of rain or melted snow water and also affords streams of waste water from irrigated farms easy opportunities to begin cutting. The low natural content of organic matter in the soil and the comparatively steep slopes on most of the farming lands are additional causes of ready erosion. The fact that the soils are sandy silt loams without much binding power makes them more than ordinarily susceptible to erosion, especially after undercutting has started." Progress in the development of a gully is illustrated.

Alkali studies.—"Sulfates and chlorides are the principal alkalies found," and the work noted has been mostly an attempt to find crop plants capable of thriving in this saline, rather than actually alkaline, soil. "Asparagus . . . made satisfactory growth in soil containing approximately 10,000 parts per million of sodium sulfate. Sunflowers were also tolerant of alkali in the soil. Barley and oats seem to have been the most tolerant of the cereals, and sweetclover seems to have been more tolerant than alfalfa. Sugar beets, if they can be grown through the seedling stage, have been satisfactory on most alkali lands."

It was further found that "a large portion of the alkali has accumulated in small areas called 'alkali spots.' These vary in size from a few square yards to several acres. These spots are generally due to seepage, the ground water being near enough the surface to allow concentration of the salts."

With regard to actually alkaline soils, "it has been found that the addition of organic matter in alkali soils (especially to those impregnated with sodium carbonate) has a marked ameliorating influence on alkali injury."

Problem of drainage.—In alkali spots and in surrounding territory, water was always found near the surface, but tile drains, given trial at a number of points, have not been successful. "The underground water does not percolate through the soil with any degree of regularity, and the soil appears in many places to be almost impermeable." The suggestion is made that the water in the seeped spots comes up under pressure, and "in some places it is thought that the impermeable subsoil barriers hold the water in 'pockets' or spots. These barriers prevent the ordinary line drains, whether tile or open, from draining off the water."

Fertilizer tests.—Chemical tests indicated a low phosphorus content in the soil, and phosphates gave larger yield increases than did other fertilizer substances. Potassium chloride also caused some increases, but the results from ammonium sulfate applications were found not significant. "By the addition

of phosphorus in the form of treble superphosphate, the yield of alfalfa was increased 50 per cent and sugar beets approximately 33 per cent." It is considered, however, that "commercial fertilizers in no sense should take the place of barnyard manure but should be used to supplement it. No other fertilizer has exhibited such a marked residual effect as has farm manure."

[Soil Survey Reports, 1926 Series] (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpts.], Ser. 1926, Nos. 24, pp. 46, pls. 4, fig. 1, maps 2; 33, pp. 38, fig. 1, map 1*).—The two surveys here noted were made with the respective cooperation of the Colorado and Iowa Experiment Stations.

No. 24. *Soil survey of the Arkansas Valley area, Colorado*, A. T. Sweet and W. Inman.—This area is in southeastern Colorado, and includes 711,680 acres covered by the present survey together with some small tracts not mapped. The area consists of a broad but comparatively shallow valley, and ranges in character from steep mountain slopes at its western end to an undulating upland sloping gradually toward the river, in the eastern or lower end of the valley.

The soils mapped and described are classified as 32 types of 12 series, as well as river wash 1.7 per cent. Prowers clay loam, 10.8 per cent of the total acreage, was the most extensive type determined.

No. 33. *Soil survey of Buchanan County, Iowa*, T. H. Benton et al.—This area in northeastern Iowa, contains 362,880 acres. Its surface features are described as "those of a till plain on which erosion has as yet had little effect," and drainage of the greater part of the county is carried by the Wapsipinicon River and its tributaries. Carrington loam and Clyde silty clay loam, constituting, respectively, 43.8 and 12.4 per cent of the area surveyed, are the more extensive among 38 types of 17 series.

Soil survey of Lyon County, Iowa, A. M. O'Neal et al. (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpt.], Ser. 1927, No. 11, pp. 24, fig. 1, map 1*).—Lyon County, located in northwestern Iowa and surveyed with the cooperation of the Iowa Experiment Station, has an area of 368,640 acres, a surface relief in general that of an undulating to rolling plain, and "a complete drainage system." The soils as here mapped and described consist of 9 series inclusive of 14 types, of which Marshall silt loam constitutes 72.4 per cent.

The temperature correction in the hydrometer method of mechanical analysis of soils, C. Richter (*Soil Sci., 31 (1931), No. 2, pp. 85–92, figs. 3*).—The author of this contribution from the Hawaii Experiment Station presents data from a study of the effect of experimental conditions in the mechanical analysis of a number of soils, concluding that "soil suspensions of the same soil at different concentrations but at the same temperature will not give identical results when the temperature correction factor of 0.35 is applied at all concentrations. The same soil suspension which gave a certain reading at 67° F. will not give the same result at a higher or lower temperature if the temperature correction factor of 0.35 is applied unconditionally. In order to obtain concordant results, the correction to be applied for each degree F. becomes considerably smaller at the lower range of the hydrometer than at the higher range. The corrections to be applied below 67° are different from those to be applied above 67°."

The nature of the curve obtained when hydrometer readings are plotted against the corresponding temperatures is graphically shown; the sliding scale nature of a correction table to give concordant results at all concentrations is pointed out; and a sliding scale correction table is tentatively suggested.

A large sand culture apparatus, F. M. Eaton (*Soil Sci., 31 (1931), No. 3, pp. 235–241, pl. 1, fig. 1*).—It is noted in this contribution from the U. S. D. A.

Bureau of Plant Industry that "if the individual pots are used for each of the different plants compared it is practically certain that the concentration of the ion of interest will vary around a different mean in each of them. These inequalities can be reduced by the use of large volumes of culture solution, but the replacements of the culture solutions necessarily must be frequent since plants of different size and kind have different transpiration and absorption rates. The sand culture beds shown . . . provide a rapid and simple method for the daily or more frequent replacement of culture solutions, and in the large sand beds space is available for extensive spreading and overlapping of roots. This overlapping of roots in the culture medium, which is common to all of the plants receiving the same treatment, serves to equalize the concentration of the solution available to the different plants between the successive replacements."

Drawings and description indicate the essential details of a form of apparatus found satisfactory for the study of the required and the toxic concentrations of boron and for like purposes.

Determination of the percentage base saturation of soils and its value in different soils at definite pH values, W. H. Pierre and G. D. Scarseth (*Soil Sci., 31 (1931), No. 2, pp. 99–114*).—The barium hydroxide-ammonium chloride method was found to give total exchange capacity values averaging 17.9 per cent higher in a group of sandy soils and 12.3 per cent higher in a group of heavier soils than did the barium acetate-ammonium chloride procedure, whereas in the case of limed soils of the last-named group the first gave values averaging only 4.4 per cent higher than those of the second method. These results are interpreted by the authors of this communication from the Alabama Experiment Station as indicating that "liming, like treating a soil with an alkaline solution, results in a 'build-up' or the formation of additional exchange complex. For this reason the $Ba(C_2H_3O_2)_2$ — NH_4Cl method seems preferable in the determination of total exchange capacity. The percentage base saturation data given in this study were therefore calculated from the total exchange capacity values obtained by the $Ba(C_2H_3O_2)_2$ — NH_4Cl method and the exchangeable hydrogen values obtained by the barium acetate method. . . . It was found that soils of the same reaction may vary considerably in their percentage base saturation. In general, it was found that the highly weathered soils, such as those from the Piedmont Plateau and some from the Coastal Plain, have a lower degree of saturation at given pH values than less weathered soils, as those from the Coastal Plain Black Belt and the Glacial and Loessial Province.

"No relation was found between the organic matter content of soils or the nature of the bases present in the exchange complex and the percentage base saturation of the soils at like pH values. The silica-sesquioxide ratio and the total exchange capacity of the colloids extracted from the soils showed a general, although imperfect, correlation with the percentage base saturation values of the soils at like pH values. . . . It was found that the avidity or strength of the acids present was quite different for different soils. In general, highly weathered soils were found to have weaker acids than less weathered soils. A good correlation was obtained between the avidity of soil acids and the percentage base saturation of soils at pH 4.80."

Hydrogen-ion concentration, aluminum concentration in the soil solution, and percentage base saturation as factors affecting plant growth on acid soils, W. H. Pierre (*Soil Sci., 31 (1931), No. 3, pp. 183–207*).—Of 13 soils, collected in Wisconsin, Illinois, South Carolina, and Alabama, formed under various climatic conditions and of various degrees of weathering, a part of each was adjusted to 5 different degrees of acidity by lime or acid treatment,

as respectively required for the purpose named. In the experiments reported in this communication from the Alabama Experiment Station corn, sorghum, and barley crops were grown, with results interpreted in part as follows:

"The 'critical hydrogen-ion concentration' for the growth of crops varied considerably with different soils; therefore, the hydrogen-ion concentration of soils can not be considered the direct cause of poor plant growth nor the main factor governing plant distribution or response to liming. . . . Aluminum was found present in very small concentrations even in the most acid soils. The concentration of aluminum in the displaced solution of the different soils at similar pH values varied considerably. There was some evidence of correlation between the concentration of aluminum in the displaced soil solution and the growth of corn on acid soils, but less correlation between the concentration of aluminum and the yield of sorghum and barley. The data are taken to indicate that soluble aluminum is not the primary factor in influencing the growth of acid-sensitive crops on acid soils. Some evidence is given for the belief that it is a secondary factor. No relation was found between the amount of phosphate in the soil solution and the concentration of aluminum in solution at which plant injury developed.

"The concentration of calcium in the soil solution bore no relationship to plant injury on these soils. A fair correlation was found to exist between the ratio of potassium to calcium in the soil solution and plant injury. As the soils became more acid the ratio of potassium to calcium decreased. This ratio varied considerably for the different soils at similar pH values. No relation was found between the concentration of manganese in solution and plant injury from soil acidity. . . . A rather good correlation was found to exist between the percentage base saturation of acid soils and plant injury. Where large amounts of aluminum were present in solution, plant injury seemed to occur at higher degrees of saturation than when aluminum was absent, or present in low concentrations.

"The percentage base saturation of soils is believed to be one of the most important factors in determining the growth of plants on acid soils. It is also suggested that differences in the relative proportion of the various bases present in the exchange complex and in the soil solution may be contributing factors to the poor plant growth obtained on acid soils."

The nature of soil acidity as affected by the SiO_2-sesquioxide ratio, L. D. Baver and G. D. Scarseth (*Soil Sci., 31 (1931), No. 3, pp. 159–173, figs. 7*).—From determinations of the silica-sesquioxide ratio, the total exchange capacity, and "the nature of the soil acids" in the colloidal material obtained from a number of soil samples "representing various kinds and states of weathering," the authors of this communication from the Alabama Experiment Station conclude that "the nature of soil acids varies considerably in different soils. In weathered soils their nature is solely a function of the kind and extent of weathering and is independent of the parent material. This indicates that there is more than one type of soil acid. Colloidal material extracted from soils that are well weathered and that have a high silica-sesquioxide ratio tends to be more highly buffered and exhibits stronger acidity than those colloids having a low ratio. Their total exchange capacity is higher. The buffer capacity of the colloids appears to be primarily a function of the nature of the soil acid. The nature of the soil acids may prove to be a valuable criterion in the classification of soils. The exchange complex may develop by removal of certain constituents from the original alumino-silicate minerals; by mutual flocculation of the colloidal oxides of aluminum, iron, and silicon, and by the precipitation of aluminum, iron, and silicon from solution.

"There is no one direct relationship between the silica-sesquioxide ratio and the total exchange capacity of the colloid or the nature of the soil acid. Three different groups appear to be manifested in which a direct relationship between these factors is indicated. It is suggested that this may be due to different types of exchange complexes, or to the presence of free oxides of aluminum, iron, and silicon. It is suggested that in order to study more accurately the relation of the chemical composition of soil colloidal material to its physico-chemical properties the present methods be so modified that a uniform colloidal fraction is isolated from the soil, and that the free oxides of aluminum, iron, and silicon are not considered in expressing the silica-sesquioxide ratio."

Permeability of soils (*New Mexico Sta. Rpt. 1930, pp. 66, 67*).—The results to date from two years' work (E. S. R., 63, p. 421) indicate that "some general changes in productivity have been observed in portions of the field, but these appear to result from natural causes on which the amendments have no influence. The third year's treatment may give positive results, but the cost per acre of the amendments already used precludes any profitable use of these materials under the conditions of the experiment."

Interaction between ammonia and soils as a new method of characterizing soil colloids, A. N. Puri (*Soil Sci., 31 (1931), No. 2, pp. 93–97*).—The author of this contribution from the University Chemical Laboratory, Lahore, India, noting that "the so-called adsorption of ammonia by soils is a chemical reaction representing the neutralization of acidoid by a base," and that "methods of estimating soil colloids based on ammonia absorption therefore can not be employed for the purpose intended," presents experimental data from which he concludes that "soils react with bases very slowly, and equilibrium condition can be reached quickly only by adding excess of alkali and removing the excess by leaching or by precipitation as some insoluble salt. A soil made completely unsaturated can combine with an amount of ammonia which may be considered equivalent to its base exchange capacity. The pH value of soils containing excess $CaCO_3$, after dilute acid treatment and ammonia saturation, is approximately the same as that of the soil in the natural condition."

The influence of combined nitrogen on growth and nitrogen fixation by *Azotobacter*, J. E. Fuller and L. F. Rettger (*Soil Sci., 31 (1931), No. 3, pp. 219–234*).—This is a contribution from Yale University, in which are reported culture experiments with Azotobacter leading to the conclusion that "Azotobacter appears to be able to fix substantial quantities of free atmospheric nitrogen when cultivated in a medium which is free from combined nitrogen and in an atmosphere which is free from ammonia and nitrous acid.

"Azotobacter did not attack blood serum or gelatin. Nucleic acid, tryptophane, and tyrosine depressed nitrogen fixation slightly, and did not influence the growth of Azotobacter. Peptone increased the growth of the organism, but decreased nitrogen fixation. Glutamic acid, aspartic acid, cysteine hydrochloride, and glycocoll appeared to be readily utilized by Azotobacter. Nitrogen fixation was definitely depressed, however, and in some cases some of the original nitrogen was lost. Growth was increased in all cultures. Cystine had little effect, probably because of its limited solubility in the medium.

"Creatine, creatinine, and urea caused increased growth in most of the cultures, but depressed nitrogen fixation almost entirely. In some of the cultures there was a loss of some of the original nitrogen. Guanine caused depression of nitrogen fixation, but did not influence growth. Indole and skatole were toxic in concentrations as low as 50 p. p. m. of nitrogen equivalent. Ammonium sulfate and potassium nitrate depressed nitrogen fixation and at the same time increased growth. Ammonium chloride, ammonium carbonate, ammonium

phosphate, ammonium nitrate, and sodium nitrate produced a greatly increased growth in a majority of the cultures, and only a very slight depression of nitrogen fixation," except in some of the cultures of one strain.

When the amount of growth was correlated with nitrogen fixation, a relative depression of fixation was apparent. In general, "the more complex organic compounds, except peptone, do not seem to be actively attacked by Azotobacter, and consequently the growth and nitrogen-fixing activity of the organism are not much influenced. The presence of simple nitrogenous compounds in commercial peptone is in all probability responsible for the results observed. The simpler organic substances, including the lower amino acids, and the inorganic compounds seem to be utilized easily by Azotobacter, with the result that growth is increased and nitrogen fixation either relatively or actually depressed. Where there is adequate evidence that the combined nitrogen is available for Azotobacter, it appears to be used in preference to the more laborious process of fixing free atmospheric nitrogen."

Changes in the availability of phosporus in irrigated rice soils, R. P. Bartholomew (*Soil Sci., 31 (1931), No. 3, pp. 209–218*).—Report is made of a field study designed to determine the effect of irrigation on the pH values of rice soils, the calcium, iron, and aluminum content and the pH value of the irrigation water having been determined, as well as the effect of irrigation on the availability of phosphorus in soils variously treated with fertilizers. The results of the experiments, which were carried out at the Arkansas Experiment Station, are stated in part as follows:

The water used was found to contain "large amounts" of calcium, mostly in the form of bicarbonate; and "from 6 to 12 p. p. m. of soluble iron and aluminum were found in the samples analyzed. The amounts of soluble calcium and iron and aluminum added annually in the irrigation water could cause reversion of large amounts of soluble phosphorus. Continued irrigation with calcareous well water has made the surface soil in the rice area decidedly more alkaline than the subsoil. Irrigation caused a decrease in the water-soluble inorganic phosphate. This was partially due to reversion of the phosphates. The increase in the organic water-soluble phosphorus three months after irrigation may be due to activities of bacteria under anaerobic conditions. Phosphatic fertilizers, according to the results of these experiments, should not be recommended when calcareous water is used for irrigation."

AGRICULTURAL BOTANY

Practical plant biochemistry, M. W. Onslow (*Cambridge, Eng.: Univ. Press, 1929, 3. ed., pp. [7]+206*).—This is the third edition of the work previously noted (E. S. R., 50, p. 626).

Environmental complexes considered as dynamic systems, B. E. Livingston (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1107–1121*).—Considering organism and environment as the internal and external portions of a single system of material and energy, and giving attention separately to these portions and the interactions that occur between them, with emphasis on the continual intertransfer of matter and energy, the author reviews the history and some phases of the known changes.

The difficult, undeveloped, and complicated nature of the topic is admitted, and the supposedly necessary viewpoints are indicated. "It is especially important that the whole world be looked upon as a complex of fluctuating processes or changes, of which the activities of our plants and of all organisms must be component parts. As physiology advances, the relations of dynamic causality will become more prominent and capable of more satisfactory treat-

ment in our biological discussions. What seems to be most needed at the present time is methods and instruments suitable for evaluating and comparing and integrating the many influences or conditions that work together to make the plant what it is and to make it do what it does."

The analogy between plant tissue and a protein, W. J. ROBBINS (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1125–1138, fig. 1*).—Attention is called to the analogy between plant tissue and a protein, also to the importance of this analogy in the physiology of the organism. Emphasis is placed also on later work done by others.

The permeability of plant integuments for ions, L. MICHAELIS (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1139–1148, figs. 2*).—An account is given of observations, investigations, and tests which were made over several decades as bearing upon the behavior of ions in contact with different plant integuments under varied conditions, the data being presented largely in tabular and descriptive form. Plantago leaf was used, as was also material of other sorts in contact with different ions.

The influence of H-ion concentration on the turgor and movement of plant cells, with special reference to stomatal behavior, G. W. SCARTH (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1151–1162, figs. 4*).—The author concludes that the normal turgor changes in guard cells are, in large part, merely a specialized example of a phenomenon which is very general, not only in living cells but also in nonliving biocolloids, namely, changes of hydration in relation to H-ion concentration. Work is outlined as done with *Spirogyra submaxima* and with *Zebrina pendula*.

It is surmised that "the H-ion factor acts in a complex fashion," though "no relation could be detected between H-ion concentration and starch content." From data indicated it is concluded that "normal movements are governed by the same changes of H-ion concentration within the guard cells as proved effective under our experimental conditions." The supposed bearings of theories offered are indicated.

Regarding the series of events that brings about opening and closure in the natural state, "the morning light initiates photosynthesis, resulting in a reduction of CO_2 concentration and the development of a more alkaline reaction within the guard cells. In response to the change of reaction, the vacuome apparently in virtue of its colloidal content quickly imbibes more water from the adjacent cells and causes distention of the guard cells. More gradually, as a result of the same H-ion change starch is hydrolyzed, and unless the cells are freely permeable to the soluble product—a point still sub judice—turgidity will be further increased thereby. Cessation of photosynthesis whether from lack of light, accumulation of photosynthetic products (?), or wilting (?) is followed by a similar series of opposite changes. Prolonged closure in darkness may possibly result in sufficient acidity, through accumulation of CO_2, to cause temporary opening along with slight hydrolysis of starch.

"This theory has an element of interest to the general biologist in the bond of similarity that it provides between the ventilatory system of plants and animals, for utterly different though the physical mechanism of gas exchange is in the two cases, the regulating chemical factor is declared to be the same. Plants, however, in virtue of their special rôle in nature, are so adapted as to regulate for a deficiency as well as for an excess of CO_2."

The influence of osmotic pressure on the growth, transpiration, and storage of ashes in tobacco [trans. title], E. M. KALITAEVA (*Gosud. Inst. Tabakoved. [Krasnodar] (State Inst. Tobacco Invest.) Bul. 62 (1929), pp. 26, figs. 10; Eng. abs., pp. 25, 26*).—In work done during 1926 with the oriental tobacco variety Varatik grown in water cultures kept renewed and dealt with

according to the method employed by Shive (E. S. R., 36, p. 328), the author undertook to study the influence of the proportion of different elements in the nutrient solutions on the growth of tobacco, the influence of the concentration of the nutrient medium on the storage of ash, calcium, and magnesium, and finally the influence of osmotic pressure on the transpiration in correlation with different proportions of the salts. A notable difference was observable from the start in the growth of tobacco in relation to the different proportions in the salts used. These are detailed.

The preface is by A. I. Smirnov.

Moisture fluctuations in extracted plant solutions and in leaf tissue, B. E. GILBERT and W. L. ADAMS (*Plant Physiol., 4 (1929), No. 4, pp. 529–536*).—Studies employing methods indicated are outlined. In beet-leaf tissue the difference between the average moisture content of petioles and blades was insignificant, though the midribs contained 3 per cent more moisture than the remaining portion of the blade. In Swiss chard and in barley grown under glass a study was made of the total daily moisture fluctuations, and by withholding water from a portion of each crop maximum differences of 7.6 and 7.3 per cent, respectively, in moisture content were found with the two crops when wilting conditions were obtained. In comparisons of soil moisture, atmometer evaporation, and total leaf-tissue moisture made with crops growing under field conditions, evaporation alone showed evidence of correlation with moisture depression.

The water content of wheat leaves at flowering time, A. M. HURD-KARRER and J. W. TAYLOR (*Plant Physiol., 4 (1929), No. 3, pp. 393–397, fig. 1*).—From evidence tabulated with discussion, it is supposed that the physiological processes involved in flowering did not exert any specific effect on their water content.

The effect of pH value and hydrogen peroxide concentration on fruit oxidase activity, W. V. CRUESS and W. Y. FONG (*Plant Physiol., 4 (1929), No. 3, pp. 363–366*).—It is stated that the respective optimum, maximum, and minimum pH values for various oxidase indicators in contact with apricot oxidase differ, but that the optimum for most lies near neutrality.

The hydrogen peroxide concentration affects greatly the intensity of the oxidase reaction with various indicators.

Peroxidase was inactivated near pH 2.0 and near 12.8 in less than three hours, and on subsequent adjustment to neutrality failed to respond positively with the usual peroxidase indicators. The organic peroxide was considerably less resistant than the peroxidase to high pH values.

In general, in any comparative studies on the activity of fruit oxidase the pH value of the medium and the hydrogen peroxide concentration should be carefully controlled and the proper indicator chosen.

The effect of pH value on the inactivation temperature of fruit oxidase, W. Y. FONG and W. V. CRUESS (*Plant Physiol., 4 (1929), No. 4, pp. 537–541*).—Inactivation temperature for peroxidase of apricots, pears, peaches, prunes, figs, lemon peel, tomato, banana, and dates varied with the H-ion concentration, resistance to heat being greatest in the range of pH 5 to 7. Resistance decreased with decrease in pH value between pH 5 and 2, and decreased with increase in pH value between pH 8 and 12. At pH 12 and pH 2 to 2.2 the peroxidase was inactivated at room temperature in 24 hours or less.

The organic peroxide behaved similarly to the peroxidase between pH 2 and 7. At values above pH 8 the organic peroxide failed to give positive tests. There was considerable evidence that the inactivating effect of temperature at any given pH is progressive rather than abrupt.

Growth studies on fruits: Respiration of tomato fruits, F. G. GUSTAFSON (*Plant Physiol.*, *4* (*1929*), *No. 3*, *pp. 349–356*, *figs. 3*).—It is claimed that in John Baer tomato fruits there occurs a decrease in the production of carbon dioxide during growth to a point of minimum production about the time of cessation of growth. After this there is an increase in carbon dioxide production to the point of orange redness, with a decrease thereafter in carbon dioxide production. This increase is attributed to a lowering of the H-ion concentration of the cell sap, the final decrease being due to a slowing down of the life activities as the fruit approaches the condition of a mixture of carbohydrate and water. It is pointed out that a difference sometimes occurs between the chronological and physiological age of tomatoes, and that the latter should be used in the study of the fruit's various activities.

Opening of stomata in different ranges of wave lengths of light, J. D. SAYRE (*Plant Physiol.*, *4* (*1929*), *No. 3*, *pp. 323–328*, *figs. 4*).—Stomata of *Rumex patientia* did not open in wave lengths greater than 690 mμ. Other regions of the visible spectrum, except the violet and ultra-violet, seemed to be equally effective. The limit of effectiveness of the blue end of the spectrum could not be determined. It is suggested that red light beyond 690 mμ does not affect plants except in so far as it is absorbed and changed into heat energy.

Relation between the development of root system and shoot under long- and short-day illumination, J. E. WEAVER and W. J. HIMMEL (*Plant Physiol.*, *4* (*1929*), *No. 4*, *pp. 435–457*, *figs. 7*).—In experimentation to determine the relative development of roots and tops of eight species of plants under 7- and 15-hour illumination for about 7 weeks in soil in containers of liberal size, red clover, radish, iris, and oats, all long-day plants as regards flowering, developed large tops and extensive root systems under the 15-hour day, the shorter exposure giving greatly and about equally retarded growth of both tops and roots. A similar response is recorded for sunflower, the time of flowering of which is less modified by the length of day. Dahlia, the great ragweed (*Ambrosia trifida*), and cosmos (*Cosmos bipinnatus*), regarded as short-day plants, attained their greatest size and root development under the 15-hour day. Under short-day illumination more food was accumulated, though both tops and roots were dwarfed.

The effect of length of daily illumination upon photosynthetic activity showed red clover, radish, and sunflower to be either more active in photosynthesis or less active in removing or using the product under long-day illumination than under a 7-hour day. Great ragweed and dahlia were more or less equally active photosynthetically during the two light periods, or less active in the use or removal of the products under short-day illumination.

Mechanism of cell wall formation, O. L. SPONSLER (*Plant Physiol.*, *4* (*1929*), *No. 3*, *pp. 329–336*, *figs. 3*).—Of the stages into which cell wall growth is divided, namely, the formation of the first cellulose layers, the surface area growth of the wall accompanying cell growth, and the increase in thickness of the wall, only the third is here considered. The attempt has been made to show that forces are inherent in the molecular structure of the wall which must share very largely in the process of building up the wall itself, at least in thickness.

An outstanding feature in the mechanism of thickness growth, it is claimed, is the part played by a surface of regularly spaced molecular units. The conclusion is suggested that the forces of crystallization form a part of the mechanism by which glucose molecules become converted into cellulose; and it was found that on account of the particular structure of the glucose molecule an opportunity was provided for a condensation reaction which would produce long straight chains of residues, or cellulose molecules. It is concluded that crys-

tallization forces alone could not account completely for the transformation of glucose to cellulose, and that a third factor which seemed to be associated with living protoplasm is necessary.

The pure pigments, carotin and xanthophyll, and the Tswett adsorption method, F. M. SCHERTZ (*Plant Physiol., 4 (1929), No. 3, pp. 337–348*).—A brief summary of work on plant yellow pigments points out specifically certain alleged inconsistencies in earlier literature, and offers what are claimed to be corrections as regards the identity and naming of xanthophyll, flavone, and carotene.

Some effects of calcium deficiency on Pisum sativum, D. DAY (*Plant Physiol., 4 (1929), No. 4, pp. 493–506, figs. 5*).—Results of observations recorded for external appearance and anatomical structure in Canada field peas grown in nutrient solutions of varying proportion as to calcium nitrate are said to show that calcium lack gives shorter plants, having the lower leaves chlorotic and the youngest leaves curled and tough, though comparison indicates that several nutrient solutions in common use contain a superoptimal proportion of calcium.

Anatomical structure in root and in stem remained practically constant whether the plants were grown under the usual garden conditions, in a nutrient solution containing the full quantity of calcium, or in a solution lacking calcium. The observable difference constituted a variation in the amount of elongation rather than in anatomical structure, as indicated by transverse sections.

Peculiar properties of differently aged tobacco leaves [trans. title], A. I. SMIRNOV ET AL. (*Gosud. Inst. Tabakoved. [Krasnodar] (State Inst. Tobacco Invest.) Bul. 46 (1928), pp. 60, pl. 1, figs. 6; Eng. abs., pp. 58, 59*).—A study with results in some detail is reported of the properties of tobacco leaves at different developmental stages and of the percentages and distribution of nitrogenous substances, carbohydrates, and organic acids, with some consideration also of respiratory energy, moisture variation, dry matter change, and water capacity.

GENETICS

A gene in maize for supernumerary cell divisions following meiosis, G. W. BEADLE (*New York Cornell Sta. Mem. 135 (1931), pp. 12, pls. 3, fig. 1*).—A recessive Mendelian factor in corn termed "polymitotic" (*po*), which results in several supernumerary divisions in microsporogenesis, was subjected to genetic and cytological studies. In polymitotic plants the cells of the microspore quartet were observed to undergo a series of meiosis-like divisions in which the chromosomes are distributed to the two poles at random and without splitting. As a result of such divisions, the number of chromosomes in the cells finally formed is much reduced, cells with only one chromosome being relatively frequent. The microcytes formed in polymitotic plants soon degenerate. The polymitotic plants are completely pollen sterile and partly female sterile, although at time of flowering they resemble phenotypically the male sterile described by Eyster (E. S. R., 47, p. 326). The polymitotic character was found to be inherited as a simple recessive, and the *po* gene appeared to be located in the *Y-Pl* linkage group about 12 units from the *Y* gene.

A direct quantitative relationship between vitamin A in corn and the number of genes for yellow pigmentation, P. C. MANGELSDORF and G. S. FRAPS (*Science, 73 (1931), No. 1887, pp. 241, 242*).—Surcropper, a white-seeded corn, and Ferguson Yellow Dent were pollinated in 1928 and 1929 at the Texas Experiment Station by a mixture of pollen from both varieties. The vitamin assay made by feeding the white (*y y y*) and pale yellow (*y y Y*) seed borne by Surcropper and the dilute yellow (*y Y Y*) and deep yellow (*Y Y Y*) produced

on Ferguson ears to albino rats, according to the Sherman-Munsell unit method (E. S. R., 54, p. 89), showed the average numbers of units of vitamin A per gram to be 0.05, 2.25, 5, and 7.5, respectively.

A white-seeded variety of corn, which ordinarily has little or no vitamin A in the endosperm according to these results, can form this substance in its seeds if the gene for yellow pigmentation is introduced. A direct quantitative relationship was observed between the number of genes for pigmentation in the cells of the endosperm and the amount of vitamin A in the seed, each gene for yellow inducing the formation of approximately 2.5 units of vitamin A per gram of seed.

Preliminary report on a study of the chromosomes in man as determined in an 8.5-mm. human embryo, F. B. Adamstone (*Anat. Rec., 44 (1929), No. 3, pp. 232, 233*).—The chromosomes in the various stages of mitotic division in an 8.5-mm. human embryo were studied. The chromosome number does not appear to confirm Painter's theory (E. S. R., 54, p. 821) that the number is 48. An approximate number of 24 is given.

A demonstration of the chromosomes of Nabours' parthenoproduced Tettigidae, including two males, W. R. B. Robertson (*Anat. Rec., 44 (1929), No. 3, p. 235*).—Diploid cells of parthenoproduced females of *Apotettix eurycephalus* and *Paratettix texanus* showed like chromosomes lying together, but in cells that contained less than the diploid chromosome number one or more of the chromosomes appeared to be of double width in the equatorial plane. It is considered that these chromosomes have not split, and therefore that the chromosome number is essentially the same. In males the X chromosome is unpaired, and an explanation for the parthenoproduction of males is given.

Sex chromosomes in different breeds of sheep and their relation to sex-linked inheritance, J. E. Wodsedalek (*Anat. Rec., 44 (1929), No. 3, p. 233*).—Breeds were found to differ in the character of the sex chromosomes in sheep. Males of the Southdown breed, which is hornless, appeared to have a single large X chromosome, while in the Lincoln breed the males also showed the presence of a Y chromosome. The Y chromosome was present in the Rambouillet and Dorset rams, which are horned. All ewes contained two X chromosomes.

Inheritance of color patterns in the grouse locust Acrydium arenosum, R. K. Nabours and I. Larson (*Anat. Rec., 44 (1929), No. 3, pp. 288, 289*).—Twenty-five elementary color patterns on the pronotum and posterior femora of this species are noted, all of which are dominant to their allelomorphs in the "wild type." Several of the patterns are similar to those found in *Paratettix texanus* and *Apotettix eurycephalus*. There are six pairs of autosomes and one sex chromosome in the male and two in the female. The percentage of crossing over is approximately the same in both sexes. The data accumulated indicate that the known factors probably fall into four linkage groups.

A complication to the genetic analysis of the origin of spontaneous cancer in mice, L. C. Strong (*Anat. Rec., 44 (1929), No. 3, p. 283*).—The author describes the unexpected variation in the genetical analysis of the incidence of spontaneous tumors in mice resulting in the division of a stock which had been inbred for 18 generations by brother and sister matings and which originally developed spontaneous carcinoma in practically all of the females. Movement of the stock from New York State to the Bussey Institution resulted in a decline in the incidence of cancer which persisted even after a transfer to Ann Arbor, Mich. At the latter place there has been a gradual increase in the cancer incidence, but the high level has not yet been obtained.

The male genital apparatus of some of our native rodents, especially the squirrels (Sciuridae), H. W. Mossman and J. W. Lawlah (*Anat. Rec., 44*

(*1929*), *No. 3, p. 243*).—The comparative anatomy of the male genital apparatus of rodents, especially the fox and gray squirrel and woodchuck, is described.

Spermatogenesis, oogenesis, and sex determination in the Columbian ground squirrel (Citellus columbianus., J. E. WODSEDALEK (*Anat. Rec., 44* (*1929*), *No. 3, p. 234*).—Detailed cytological studies of the germ cells and somatic tissues of this species demonstrated the presence of a single large X chromosome in males and two X chromosomes in females. There were also 32 autosomes in both sexes. The reduction division in the male occurred at the first spermatocyte division, while reduction occurred in the female in the throwing off of the first polar body.

A further study of the epididymal spermatozoan relationship in the guinea pig, W. C. YOUNG (*Anat. Rec., 44* (*1929*), *No. 3, p. 252*).—A comparison of the ability of spermatozoa taken from the posterior as contrasted with the anterior end of the epididymis of guinea pigs to complete the fertilization process indicated that an important phase of spermatozoan development continued in the epididymis. When the epididymis was ligated, the younger spermatozoa in the anterior end were matured and were as capable, or more capable, of fertilizing ova than the overmature spermatozoa of the posterior end.

Distribution of areolae (rosettes) on the surface of the chorion of the pig, C. E. ABROMAVICH, JR. (*Anat. Rec., 44* (*1929*), *No. 3, p. 245*).—A study of a series of pig embryos ranging from 5 mm. to full term showed that there was an increase in the number of areolas on the chorionic surface as gestation advanced. Variations in the number of areolas per unit surface during different stages of gestation were also noted.

Delayed implantation in the mammals, and its supposed relationship to polyembryony, G. W. D. HAMLETT (*Anat. Rec., 44* (*1929*), *No. 3, p. 251*).—The suggestion that the polyembryonic characteristics in the armadillo are due to delayed implantation appears false, since in the badger and black bear there was found to be a considerable delay and yet a single embryo was produced from each ovum, and the matter of twinning in the European species seems to be ruled out.

The relation of differentiation to species specificity as shown by grafts of duck kidney on the chorio-allantoic membrane of the chick, C. J. SANDSTROM (*Anat. Rec., 44* (*1929*), *No. 3, p. 251*).—Studies of the development of kidneys from duck embryos 13 to 28 days of age and from ducklings and adult ducks grafted on the chick chorio-allantois of 9-day embryos showed that the duck tissue grew normally until at least 24 days old. After it was completely differentiated, however, the grafted tissue became necrotic. The results indicated that species specificity was correlated with the degree of differentiation of the duck kidney, reaching its fullest expression when differentiation was complete.

Testis grafts in the bilaterally ovariotomized fowl, L. V. DOMM (*Anat. Rec., 44* (*1929*), *No. 3, pp. 204, 205*).—Bilaterally ovariotomized Brown Leghorn fowls simultaneously engrafted with juvenile testes were found to retain indefinitely the characteristic male plumage. Such birds developed prominent head furnishings, crowed, fought other males, and attempted to tread females. Spurs also developed, as well as growth of the vas deferens.

Attempts to induce intra-uterine migration of the ovum in the white rat, E. D. CRABB (*Anat. Rec., 44* (*1929*), *No. 3, p. 220*).—The results of several experiments indicate that migration from one horn to the other in the rat is rare, if it occurs at all, and that the reversal of a section of one of the uteri impedes the ascent of spermatozoa, the descent of the blastocyst, and the occurrence of fertilization in the rat.

Extratubal ova in the albino rat, L. I. Wright (*Anat. Rec., 44 (1929), No. 3, p. 259*).—Three ova found between the ovary and tube in rats which had been inseminated 27 hours are described. These ova appeared to be in the monaster stage, probably for the second polar division.

A breeding and a non-breeding season in the monkey, Macacus rhesus, C. G. Hartman (*Anat. Rec., 44 (1929), No. 3, pp. 226, 227*).—The optimum time for conception in the monkey appeared to be during the months of October to January, while May to August is considered as the nonbreeding season. From evidence accumulated it appeared that menstruation could occur without ovulation, indicating that the corpus luteum is not the prime regulator of the menstrual process.

The fertile period of the menstrual cycle in the monkey, C. G. Hartman (*Anat. Rec., 44 (1929), No. 3, p. 226*).—From a study of a number of matings in the monkey it appeared that fertile coitus was most likely to take place between the ninth and the twelfth day of the menstrual cycle, the female at other stages of the cycle being sterile.

Physiological studies of the corpus luteum, F. L. Hisaw, R. K. Meyer, H. L. Fevold, and S. L. Leonard (*Anat. Rec., 44 (1929), No. 3, p. 205*).—Extracts of sow corpora lutea were prepared which were functional in causing relaxation of the pelvic ligaments of the guinea pig, inhibition of oestrum and ovulation, production of changes characteristic of pregnancy in the vaginal mucosa and uterus of rats, promoting the growth of placentomata, development of the progestational endometrium in the uterus of rabbits, inhibiting the action of implants of the anterior lobe of the hypophysis in sexually immature rats, and inhibition of uterine contractions. For many of these reactions it was found that the follicular hormone must first produce its effects before the corpus luteum hormone can act. Two fractions of the corpus luteum hormone have been produced, one of which is crystalline and causes relaxation of the pelvic ligaments, while the other is noncrystalline and brings about the other changes.

Extracts of corpora lutea in relation to pregnancy, R. G. Harris and J. J. Pfiffner (*Anat. Rec., 44 (1929), No. 3, pp. 205, 206*).—Extirpation of both ovaries from pregnant rats resulted in abortion within an average of 2.22 days. The extraction of fresh corpora lutea from sows with hot methyl alcohol produced a substance which when injected into pregnant rats permitted the continuance of pregnancy to term in 11 of 12 animals tested. This extract evidently interfered with parturition.

The prolongation of pregnancy by extracts of corpus luteum, W. O. Nelson, J. J. Pfiffner, and H. O. Haterius (*Anat. Rec., 44 (1929), No. 3, p. 230*).—In these experiments methyl-alcoholic extracts of corpora lutea from pregnant sows, when injected into pregnant rats, prolonged the period of pregnancy from 30 to 150 hours, and resulted in stillbirths in all cases where the prolonged period was greater than 70 hours.

Crystals from the anterior lobe of the hypophysis and their effect upon immature mice, P. E. Claus (*Anat. Rec., 44 (1929), No. 3, p. 206*).—By fractionation of an acid alcohol extract of desiccated anterior lobe of the hypophysis a crystalline substance was obtained which induced precocious sexual maturity in female mice, while a second fraction caused the follicles to become filled with lutein tissue inclosing the ova and preventing ovulation. The crystalline substance also tended to speed up sexual maturity in male mice, although growth of the testes was not stimulated.

Crystals having the properties of the above crystalline substance have been obtained from the urine of pregnant women and from the epididymis of the bull.

The effect of female hormone on plumage and oviduct of bilaterally ovariotomized fowl, L. V. DOMM and R. G. GUSTAVSON (*Anat. Rec., 44 (1929), No. 3, p. 228*).—The daily injection of female hormone of human placental origin in bilaterally ovariotomized fowls caused a material increase in the size of the oviduct with glandular development comparable to that in the early preovulation of the pullet. The secondary sex characters were unmodified.

Studies on the effect of thymectomy on growing chickens, J. E. ACKERT and M. H. MORRIS (*Anat. Rec., 44 (1929), No. 3, p. 209*).—The thymus glands of 90 White Leghorn chicks were completely removed without apparent effect on the weight of eggs produced; strength of eggshells; calcium carbonate in eggshells; appearance and thickness of eggshells; fertility and hatchability of eggs; length of spurs and tibiotarsi; weights of testes, livers, and gizzards; hemoglobin and sugar in the blood; and resistance to intestinal roundworms.

Effects of thymectomy in domestic fowl, A. MORGAN and M. GRIERSON (*Anat. Rec., 44 (1929), No. 3, p. 221*).—In a series of experiments the thymus glands were removed at from 13 to 107 days of age, with second operations to determine the completion of the removal and regeneration.

From these studies it appeared that the size and number of eggs and the formation of albumin and shell were entirely normal in operated females.

Some effects of hyperthyroidism in the Brown Leghorn fowl, L. V. DOMM (*Anat. Rec., 44 (1929), No. 3, pp. 227, 228*).—The first noticeable effect of the administration of desiccated thyroid to Brown Leghorn cocks was the replacement of the hackel, back, saddle, and wing-bow feathers by feathers totally or nearly black, with reduction in the peripheral area of barbule-free barbs, and the shortening and rounding of hackle and saddle feathers. After long medication, there was some depigmentation observed and the birds showed nervousness.

The effects in capons were comparable. In females the back, saddle, and hackle feathers showed similar characteristics, while new breast feathers revealed a conspicuous black mottling.

Effect of bodily injury on egg laying in fowls, M. STEGGERDA (*Anat. Rec., 44 (1929), No. 3, pp. 209, 210*).—In studies of the influence of injury on egg production two operations were tested, one in which the thin membrane covering the ovary of immature pullets was removed, and the other in which 10 cc. of blood was drawn from the wing at 2-week intervals for a period of 12 weeks. There was no significant difference between the operated birds and the controls. However, the operated birds were more variable, and it is concluded that some birds were stimulated to lay more eggs as a result of the operation, whereas others produced fewer eggs. Mortality was greater among the controls.

The period of gestation in the monkey, Macacus rhesus, C. G. HARTMAN (*Anat. Rec., 44 (1929), No. 3, p. 226*).—The average duration of pregnancy for 15 normal terms in the monkey was 164.3 days. Of these there were 10 multiparae averaging 162.5 days, and 5 primiparae averaging 169 days.

Parabiosis of the Leghorn fowl, A. W. KOZELKA (*Anat. Rec., 44 (1929), No. 3, p. 209*).—Thirty-seven pairs of parabiotic chicks lived to more than three weeks of age, and six pairs were of opposite sexes. The sex hormones of the female did not appear to influence the growth of the secondary sexual structures of the male. Each sex developed the characteristic comb and wattles for its sex. There appeared to be an interchange of blood between the members of each pair.

Finger prints of twins, H. H. NEWMAN (*Anat. Rec., 44 (1929), No. 3, pp. 282, 283*).—Comparison of the finger prints of 50 pairs of monozygotic and 50

pairs of dizygotic twins indicated that one or both hands of one identical twin are more similar to one or both hands of the other twin than are the two hands of the same individual. The prints of the two hands of the same individual were not more similar in identical than in fraternal twins.

FIELD CROPS

A method of estimating the yield of a missing plot in field experimental work, F. E. ALLAN and J. WISHART (*Jour. Agr. Sci. [England], 20 (1930), No. 3, pp. 399–406*).—A method developed at the Rothamsted Experimental Station furnishes an estimate of the yield of a missing plat in field experiments, based on all the other values. If the experiment was arranged in randomized blocks, the desired value is determined by the equation—

$$k(n-1)(s-1)=(n+s-1)S-s.S_t-n.S_b,$$

wherein s=treatments, n replicates of each, S_t sum of treatment totals not including the block with the missing plat, S_b sum of block totals not including the block with the missing plat, S sum of all the known $(ns-1)$ plat yields. In a Latin square arrangement—

$$k=\frac{1}{n-1}S_1+\frac{2}{(n-1)(n-2)}S_2,$$

wherein S_1 represents the sum of the yields of the 3 $(n-1)$ plats agreeing with the missing plat in row, column, or treatment, and S_2 the sum of the plats not agreeing.

[Agronomic experiments in New Mexico] (*New Mexico Sta. Rpt. 1930, pp. 17–25, 30, 31–40, 52–54, 68, 69, 85, 86, 90, 98–101, figs. 3*).—Field crop investigations (E. S. R., 63, p. 434) reported on from the station and from outlying fields near Clayton, Capulin, Mosquero, and Clovis included variety tests with winter and spring sown wheat, oats, and barley, corn, grain sorghum, sorgo, cotton (E. S. R., 63, p. 527), sugar beets, sweetpotatoes, beans, alfalfa, millet, and miscellaneous hay crops; breeding work and biometrical (E. S. R., 63, p. 731) and genetic studies with cotton; cultural (including planting) tests with cotton, wheat, and Sudan grass; fertilizer trials with cotton and alfalfa; irrigation tests with potatoes; studies on the annual production of sugar beet seed (E. S. R., 65, p. 36); trials of range plants (E. S. R., 65, p. 32); storage tests with manure; and trials of chlorate sprays for the control of Johnson grass.

Cotton yields on adobe soil differed little, regardless of spacing, although unthinned cotton yielded about 17 per cent less than that thinned to single plants 1 ft. apart. Topping did not increase yields appreciably and is not recommended. The stand, lint percentage, yield of bollies, and rate of maturity of cotton were about the same under either flood or furrow irrigation, although the total yields in furrow-irrigated plats were slightly larger. No legume was found satisfactory as a winter cover crop in cotton fields.

Studies of range grasses showed that if the cost is not prohibitive large areas in New Mexico can be reseeded, without irrigation, to blue grama grass and that in many sections *Bromus inermis* will make growth about 1 ft. high on plowed ground kept fairly free from weeds when precipitation is at least normal. A machine designed for harvesting bluegrass seed was found fairly well adapted for gathering blue grama grass seed, provided the grass is at least 14 or 16 in. high at harvest. Pot-test indications were that blue grama seed should not be planted deeper than about 0.5 in. in sandy loam soil. It appeared that a stratum of rock or a solid mass of caliche within a few feet

of the surface may prevent the successful growth of chamiza (*Atriplex canescens*). Winter fat (*Eurotia lanata*) seed evidently should not be planted deeper than about 0.25 in.

Wheat yields in dry farming areas were better in 1929 than in 1928, but the average protein content dropped from 14.7 to about 12.4 per cent. Under irrigation the yield increase was slight, but the protein fell almost as much, 12.45 to 10.7 per cent, as in the dry-farming areas. Apparently seasonal conditions influenced both areas, increasing the yield but decreasing the protein. Seasonal conditions seemed to have a greater influence on both percentage of protein and yield than did variety.

[Crops experiments on the Carbon County, Utah, Experimental Farm, 1927 to 1930, inclusive], I. D. ZOBELL and G. STEWART (*Utah Sta. Bul. 225* (*1931*), *pp. 9, 10, 13–17, 19, 20, figs. 2*).—Outstanding varieties comprised Extra Early Minnesota No. 13 and Northwestern Dent corn, Dicklow and a Utah Station hybrid (14–85) wheat, Swedish Select oats, Trebi barley, Great Northern, pinto, and White Wonder beans, and Rural, Cobbler, Early Eureka, Bliss Triumph, and Brown Beauty potatoes. The yields and sugar contents of 15 varieties of sugar beets are tabulated. Alfalfa was the best forage tested, and its yield was nearly doubled by applications of phosphorus. All rotations tested seemed satisfactory.

Fall plowing seemed better adapted to the conditions of the region than spring plowing, and ordinary plowing 7 to 8 in. deep was better than deep plowing (11 to 12 in.). For some crops preirrigation before seeding has given good results.

Grains for cut-over lands of northern Idaho, J. H. CHRIST (*Idaho Sta. Bul. 178* (*1931*), *pp. 16, figs. 5*).—Production practices for growing small grains, field peas, and grain hay on the cut-over lands of northern Idaho are outlined from experience and experiments at the Sandpoint Substation.

Varieties showing up well in tests included Mosida winter wheat; Pacific Bluestem, Jenkin, and Defiance (late varieties), and Supreme spring wheats; Hannchen and Charlottetown 80 barley; Idamine, Markton, Abundance, Banner, and Nova oats; and White Canada and Kaiser field peas. The yields of miscellaneous crops over periods are also tabulated.

Fall-seeded rye and vetch outyielded other combinations for grain hay, although winter wheat and vetch also yielding well were much more suitable for feed. Spring-sown oats and peas and wheat and peas outyielded barley and peas and wheat and vetch. Seeding tests indicated early dates for winter wheat and field peas and a mid-early date for spring wheat and a 90-lb. acre rate for wheat, 2 bu. for barley, 2 to 3 bu. for oats, and the heavier rates for field peas and for oats and peas for hay. A substantial increase in yield followed rolling after seeding spring wheat.

Effect of consolidation upon the botanical composition of poor grass land, G. H. BATES (*Jour. Min. Agr.* [*Gt. Brit.*], *37* (*1930*), *No. 6, pp. 583–589*).—The effects of consolidation, i. e., any mechanical compression or treading of the surface of grassland by animal or human agency, were studied on gateway areas in pastures and on footpaths in paddocks and woods. *Poa pratensis*, *Lolium perenne*, *Trifolium repens*, *Dactylis glomerata*, and *Cynosurus cristatus* were dominant or subdominant in every case and practically excluded other species. When grown in separate repeated strips and the ground then utilized as a garden path and trodden daily, *P. pratensis* assumed a low dense habit and *D. glomerata* and *L. perenne* were suppressed in growth but persisted, whereas *Anthoxanthum odoratum*, *Alopecurus pratensis*, and *Agrostis vulgaris* were exterminated by the treading.

The changes in the herbage due to consolidation seemed to be caused primarily by the eradication of species not structurally adapted to resist treading or crushing by implements and the advent of adapted species. Consolidation evidently restricts the development even of adapted species and if extreme will result in their extermination. The zonation of herbage about a gateway indicated that species exhibit varying degrees of resistance. In experimentation, close mowing is not deemed a true imitation of close grazing, since in mowing there is no consolidation by the hoof.

The comparative drought resistance of sorghums and corn, J. H. MARTIN (*Jour. Amer. Soc. Agron., 22 (1930), No. 12, pp. 993–1003*).—Compared with corn, sorghum was observed to have leaves with stomata smaller and more numerous per unit area, plants less leafy and with more secondary roots, leaf juices with lower osmotic concentration and stalk, crown, and root juices with higher osmotic concentration, a lower transpiration ratio under high evaporation conditions, stalks with lower moisture content, and leaves and stalks that wilted and dried more slowly. The slower drying evidently permits sorghum plants to withstand drought longer than corn, and they may subsequently recover when moisture becomes available. The waxy cuticle of the stems and leaves apparently is largely responsible for the slow drying of sorghums. The author believes that the sorghum stalk recovers from a dormancy induced by drought chiefly because it has not wilted beyond recovery. It is pointed out that sorghum plants can send up tillers and still produce a good crop if rain comes after the main stalks have been killed by drought. Early types of grain sorghum sometimes partly escape drought and produce some grain before the soil moisture becomes exhausted when kafir is a complete failure.

Winter legumes for green manure in the Cotton Belt, R. MCKEE and A. D. MCNAIR (*U. S. Dept. Agr., Farmers' Bul. 1663 (1931), pp. II+21, figs. 7*).—Production practices suitable for growing winter legumes for green manure in the Cotton Belt are described, together with information on the time for turning under for green manure, yields, effects on succeeding crops and residual effects, and insect pests of winter legumes. The merits of different vetches, peas, clovers, and other legumes for the purpose are discussed briefly.

Studies in crop variation.—VII, The influence of rainfall on the yield of barley at Rothamsted, J. WISHART and W. A. MACKENZIE (TYRRELL) (*Jour. Agr. Sci. [England], 20 (1930), No. 3, pp. 417–439, figs. 7*).—The seventh number of this series (E. S. R., 63, p. 731) deals with a study of the influence of rainfall on the barley of the Hoos Field plats (E. S. R., 52, p. 526), using the method devised by Fisher (E. S. R., 53, p. 14).

Excess of rain seemed beneficial to barley for a short period in summer and in certain plats over the autumn and winter period, being in contrast to corresponding results for wheat on Broadbalk Field where excess of rain was found beneficial only on a few plats and over a very limited period. Rainfall during the six months when the barley is not in the ground appeared as important as that in spring and summer, and the time at which the rain falls in winter also seemed important. The important effect of excess of winter rain was indicated in the reduction of the yield of plats having phosphate but no alkali salts, as potash, soda, or magnesia. Excessive rain at planting time was harmful in all cases. The indication of summer benefit was not inconsistent with the conclusions of Hooker (E. S. R., 47, p. 809) that a cool summer is desirable for barley.

The cotton plant, I, II, R. C. P. BOONE (*Le Cotonnier. Paris: Soc. Éd. Géogr. Marit. et Colon., 1929, vol. 1, pp. XX+307, pls. 26, fig. 1; 1930, vol. 2, pp. [4]+438, pls. 37, figs. 20*).—Volume 1 of this comprehensive work deals principally with species and varieties of cotton, choice of variety, inheritance,

hybridization and selection, and the growth and development of the cotton plant. Volume 2 treats of the culture of cotton as an annual and a perennial, climate, soils, cultural methods, irrigation, rotations, fertilizers, the chemical composition of the cotton plant and its organs and the soil, harvesting, and yields.

The natural crossing of cotton flowers in Egypt: Its distribution in time and space, and its cause, W. L. Balls et al. (*Egypt Min. Agr., Tech. and Sci. Serv. Bul. 89 (1929), pp. [1]+27, figs. 3*).—A large weekly variation appeared to exist in the amount of vicinism or natural crossing in cotton, and indications were that this may last sometimes only for two or three days. The maximum vicinism probably occurs in the first picking throughout Egypt and not only at Giza. Such variations seem attributable to the habits of pollen-carrying insects. At the season of maximum vicinism the incidence per ovule seemed to be at least 1 per 1,000 at distances as great as 100 meters when contamination takes place from a line front.

The small wild Hymenoptera, such as Nomia, were shown to be more important than the honeybee as the agents of natural crossing. The view of diffusion from the margin of the field inward was substantiated, except for the large Hymenoptera which appeared to be of the third order of importance. No other causal agents seemed active, making the idea of bee-proof gauze cages appear sound. A gauze of 64 meshes per square inch was fine enough to arrest all these agents.

Growth fluctuations during the development of seed-cotton, W. L. Balls (*Egypt Min. Agr., Tech. and Sci. Serv. Bul. 101 (1930), pp. [2]+15, pls. 2*).—Measurements of 13 seed and lint characters of seed cotton from bolls opening for 80 consecutive days on some 200 plants of a pure line showed the range of variation to be quite similar for all characters except cell diameter and breaking stress of the secondary wall, which seemed specific and barely subject to fluctuation. The predominant environmental factor was root immersion by a rising water table, accompanied by senescence effects. Ginning outturn depended primarily on the number of fibers per seed.

Sand-sowing in cotton-breeding, G. Abouleila (*Egypt Min. Agr., Tech. and Sci. Serv. Bul. 80 (1929), pp. [1]+19, figs. 12*).—When seed of Egyptian cotton in breeding work were planted in a hole formed by a cone-shaped dibble to a depth of 25 mm., better germination was had than where the cottonseed were planted with okra to insure emergence. Soaking the seed did not appear necessary, especially where watering followed planting.

Annual report of the Indian Central Cotton Committee, Bombay, for the year ending August 31st, 1930, J. H. Ritchie et al. (*Indian Cent. Cotton Com., Bombay, Ann. Rpt. 1930, pp. [2]+113*).—The progress of technological research, marketing, and administrative activities of the organization in different localities in India is reported on for the year ended August 31, 1930. The work of the Technological Laboratory with cotton in 1929–30 is reviewed (pp. 45–74) by A. J. Turner.

The time to harvest fiber flax, B. B. Robinson (*U. S. Dept. Agr., Tech. Bul. 236 (1931), pp. 23, figs. 7*).—Fiber flax of the Saginaw variety grown in cooperation with the Michigan Experiment Station during 1926, 1927, and 1928 was pulled at different stages of maturity, and intensive study was accorded the morphological appearance of the plants as correlated with yields and certain other characters of the straw, seed, and fiber. The data indicated that fiber flax should be harvested during the yellow ripe stage for best results in yield and quality of both fiber and seed, the date when this stage was reached (July 25–26) corresponding very closely to the average seasonal time for harvest at East Lansing. (central) Mich., but was about a week or 10 days earlier than in

the "thumb," the principal flax-growing area of the State, where harvest begins about August 1.

Peanut breeding, W. E. STOKES and F. H. HULL (*Jour. Amer. Soc. Agron., 22 (1930), No. 12, pp. 1004–1019*).—A preliminary report of the peanut-breeding work of the Florida Experiment Station deals with selection, hybridization, species crosses, and special technic.

Definitely higher yielding strains of Spanish peanuts resulted from plant-row selection on the basis of yield of sound nuts. Production of improved varieties combining such characters as seed dormancy, erect type, large seed, dark green foliage, light tan seed coat, and high or low oil appeared possible by hybridization and selection.

The seed dormancy as found in runner type peanuts contrasted to nondormancy as in Spanish type peanuts appeared to be inherent and not to depend upon an impervious or protective seed coat. Dormancy was incompletely dominant to nondormancy. Comparison of certain characters indicative of vigor in 11 different crosses and in the parent strains did not show excess vigor in F_1 hybrids. Seed coat color in common peanuts varied from brick red as in Valencia to russet as in the runner types and to light tan as in White Spanish. Brick red behaved as a unifactoral dominant to light tan. In the cross *Arachis hypogaea* × *A. nambyquarae*, the F_1 hybrids in general were intermediate to the parent species and appeared to be fully fertile. The red color of the testa in *A. nambyquarae* was dominant to russet and light tan in *A. hypogaea*. Variegation in the seed coat as in *A. nambyquarae* was incompletely dominant to seed color as in *A. hypogaea*.

Emasculation of peanut blossoms could be performed successfully when the calyx tubes had reached about one-half of their mature length, usually between 9 and 11 p. m. Hand pollinations were successful if performed in the morning following emasculation.

Peanut growing, W. R. and J. H. BEATTIE (*U. S. Dept. Agr., Farmers' Bul. 1656 (1931), pp. [2]+29, figs. 19*).—This is a revision of and supersedes Farmers' Bulletin 1127 (E. S. R., 44, p. 37) entitled Peanut Growing for Profit.

Some recent investigations into sugar beet problems, I–III, G. R. CLARKE, L. F. NEWMAN, and A. W. LING (*Jour. Min. Agr. [Gt. Brit.], 36 (1930), Nos. 10, pp. 950–960; 11, pp. 1061–1068; 12, pp. 1159–1166*).—Experiments with sugar beets at Bristol, Cambridge, and Oxford, England, were concerned with storage, methods of analysis, and the rate of sugar production during the growing period.

From the data obtained at all three centers during the abnormal season of 1927–28, indications were that under adverse climatic conditions beets stored either in clamps or under covered sheds lose both moisture and total dry matter and that beets crowned before storage may deteriorate seriously, mainly due to fungi attacking the beets on the cut surface left by crowning. A greater loss probably was sustained by secondary growth in imperfectly cut or in uncrowned beets. The loss sustained by beets stored under conditions obtaining in 1928–29, more representative of normal English weather, was considered very small.

Trials of analytical methods showed that with the Sachs-le-Docte and Pellet hot digestion methods comparable sugar percentages were obtained from the same sample of pulp. Of methods giving comparable results, the first process seemed more convenient to the routine sugar analyst, due to its simplicity and rapidity.

Results in three years on a mixed type of soil derived from Old River gravels and on a heavy calcareous soil derived from Boulder clay showed a very fair uniformity, and indicated quite clearly that early lifting means a considerable

loss in total sugar weight to the grower. About October 31 seemed to be the time of optimum condition of the beet, both in sugar percentage and total crop weight.

Better sugar-beet culture for Utah, G. STEWART and D. W PITTMAN (*Utah Sta. Circ. 93 (1931), pp. 32, figs. 8*).—Practical information is given on factors involved in the production of sugar beets in Utah, soils and fertility, cultural and field practices, irrigation and harvesting, and on ways to avoid damage by leafhoppers and nematodes.

Composition and quality of Pennsylvania cigar-leaf tobacco as related to fertilizer treatment, D E. HALEY, J. B. LONGENECKER, and O. OLSON (*Plant Physiol., 6 (1931), No. 1, pp. 177–182*).—In further studies (E. S. R., 59, p. 831; 62, p. 37) on cigar-leaf tobacco grown by the Pennsylvania Experiment Station at Ephrata, Pa., in cooperation with the U. S. D. A. Tobacco Investigations, the fertilizer treatments employed (various combinations and rates of manure, cottonseed meal, precipitated bone phosphate, sodium nitrate, potassium sulfate, potassium carbonate, and urea) did not alter materially the ratio of potassium to calcium in the cured leaves. Increases in the quantity of potassium sulfate did not result in larger quantities of sulfur in the leaves.

During fermentation there was an apparent increase of soluble ash constituents in the leaves. Narrowing of the nitrogen-carbon ratio occurred during fermentation, but very little, if any, nitrogen was lost. The effect of the fertilizer treatment on the burning qualities of the cigars made from differently treated tobaccos seemed to be overshadowed by insufficient fermentation and aging. Qualitative tests of the cigars showed a relatively high concentration of chlorophyll, not only undesirable itself but also indicative of insufficient fermentation.

A study of the ammonia content of cigar smoke, D. E. HALEY, C. O. JENSEN, and O. OLSON (*Plant Physiol., 6 (1931), No. 1, pp. 183–187, fig. 1*).—Tests involving apparatus devised for the intermittent smoking of cigars made from tobacco grown on plats receiving the fertilizer treatments noted above revealed no relation between the ammonia content of cigar smoke and the fertilizer treatment received by the tobacco.

Crops to replace spring wheat in northern Idaho, H. W. HULBERT (*Idaho Sta. Bul. 177 (1931), pp. 11, fig. 1*).—Barley, oats, and field peas appeared to be good crops to replace spring wheat, currently unprofitable in most of northern Idaho. Soybeans are adapted to the warmer areas where corn and beans are profitable. In certain parts of the region good seed crops of alfalfa, red clover, alsike clover, and of bromegrass, meadow fescue, slender wheatgrass, and the ryegrasses can be grown. Flax is not advised under the circumstances, and hay probably should be grown only as a supply crop for feed or for the local market.

The eradication of slender foxtail, A. W. LING and W. T. PRICE (*Jour. Min. Agr. [Gt. Brit.], 36 (1930), No. 10, pp. 967–970, pl. 1*).—Deep burial, in experiments by the University of Bristol, did not kill all the seed of slender foxtail (*Alopecurus agrestis*), or black grass; it tended to preserve vitality as compared with shallow burial, and thus enabled free germination of seed brought to the surface. Suggested control methods include prevention of introduction and seeding, following infested grain in rotation by root crops thoroughly cultivated, or continuous cropping with spring sown instead of fall sown crops. Top-dressing in early spring with a nitrogenous fertilizer, as calcium cyanamide was found effective in checking the grass, the stimulated grain crop tending to smother the weed. The same effect on slender foxtail was also noted when a wheat crop was wet sprayed with ammonium sulfate for the destruction of buttercup (*Ranunculus arvensis*).

HORTICULTURE

Hortus, compiled by L. H. and E. Z. BAILEY (*New York: Macmillan Co., 1930, pp. 652, pls. 16, figs. 22*).—A concise dictionary of gardening, general horticulture, and cultivated plants in North America.

[Horticulture at the New Mexico Station] (*New Mexico Sta. Rpt. 1930, pp. 67, 68, 78–85, 87–90, 91, 92, figs. 3*).—Of some 13 samples of apples collected in commercial orchards only one exceeded 0.012 grain of arsenic trioxide per pound of fruit. Samples from the station orchard where spraying was heavier and rainfall less showed more residue, ranging from 0.0231 to 0.0698 grain per pound.

Spring freezes continued as a menace to fruit production (E. S. R., 63, p. 443). Following the heavy crop of 1929 early peaches and plums were killed in 1930 by a temperature of 24.5° F. on March 29 and 30. Although apples bloomed later, they failed to set full crops. Delicious, Jonathan, Arkansas Black, and Gano have been consistent bearers and White Winter Pearmain an outstanding biennial producer.

Comparing tomato plants set out March 22 and protected with hotkaps with others set out April 8 and 20, the results were badly confused by an epidemic of western blight. The April 20 planting suffered the least and produced a fair crop.

Continuing cabbage fertility studies, a total of 21 treatments were compared, with an average yield for all treatments of 17,827 lbs. per acre. The maximum yield, 27,552 lbs., was obtained on the area receiving 400 lbs. each of ammonium sulfate and superphosphate and green manure (cowpeas) on the acre basis.

Data are presented on the results of variety tests with cherries, bush fruits, pecans, walnuts, and grapes. Some comments are also presented on cooperative cultural and varietal tests at various points with onions, cabbage, cherries, watermelons, sweet peas, and various ornamentals.

Little difference was secured in the control of codling moth on apples whether five lead arsenate sprays or three lead arsenate and two oil sprays were applied. Since unsprayed fruit was 85 per cent free, the codling moth was apparently not a severe factor.

Changes in carbohydrate content of White Bush squash during maturation and storage, H. B. CORDNER and W. A. MATTHEWS (*Amer. Soc. Hort. Sci. Proc., 27 (1930), pp. 520–523*).—Analyzing fruits of different ages, the authors found in this study at the University of Maryland that accompanying the uniform and rapid growth rate from the first to the eleventh day following anthesis there was a marked increase in free reducing substances, with no definite changes in sucrose, starch, or acid hydrolyzable substances. Edibility of the squash was limited by the hardening of the rind rather than compositional changes. Low temperatures in storage proved desirable from the viewpoint of conserving carbohydrates.

Growth studies on fruits: The effect of the removal of alternate flower clusters on the development of fruits in the tomato, F. G. GUSTAFSON and H. E. LAING (*Mich. Acad. Sci. Arts, and Letters, Papers 13 (1930), pp. 95–99*).—With all plants pruned to one stem the number of fruits developing per cluster was greatly increased when every other cluster was removed, but the total number of fruits per plant was about equal in both cases. The total yield per plant was somewhat decreased by removal of the clusters. Reduction in the number of fruits per cluster with advancing age was most evident in the control plants, supporting the authors' view that lack of nutrients rather than the development of inhibiting substances is the limiting factor

in growth. Attempts to influence the nutrition of individual clusters by girdling were offset by the rapid development of new cambium and phloem tissues.

Apple breeding in Idaho, C. C. Vincent and L. E. Longley (*Idaho Sta. Research Bul. 8 (1930), pp. 58, figs. 10*).—An analysis of a large number of seedling progenies obtained in apple-breeding work in progress since 1909 revealed certain marked tendencies in inheritance of characters. For example, the upright tree typified by Wagener was apparently dominant to the more spreading type, such as found in Ben Davis. Parentage was apparently a factor in the time that seedlings came into fruiting. In respect to fruit shape, a high percentage of the seedlings were intermediate between the two parents, though some were entirely different from either parent. A fairly close correlation was noted between the thickness and the toughness of the skin. A wide range in color was found in the progeny quite regardless of parental color, although Jonathan was one variety that seemed to carry a factor for the production of red. Only one seedling with Jonathan parentage produced no red coloration. A large percentage of seedlings had medium to tough flesh, a fact said to eliminate them from commercial consideration. In flavor each cross yielded a wide range of seedlings from sweet through subacid to sour, but the mean acidity of any progeny was affected by that of the parents; if one or both parents were highly acid the mean was high, and, reciprocally, low as the parents were low. Flesh color appeared in two series, white through cream color to orange yellow and greenish. Seedlings having Rome as one parent contained a high percentage of greenish color.

Composition of fruit-bud and spur tissues of Wealthy apples under different conditions of nutrition, A. J. Heinicke (*Amer. Soc. Hort. Sci. Proc., 27 (1930), pp. 190–198*).—Wealthy apple trees planted at Cornell University in 1911 were not thrown out of their characteristic biennial fruiting habit which they had maintained since the beginning of fruiting, despite applications of nitrate of soda approximating 80 lbs. per tree per year and continued for several years, even when supplemented in certain cases by heavy pruning. Spurs, 5 to 25 mm. of new growth, collected from the heavily and moderately nitrated trees were divided into the bud and woody growth portions and analyzed for nitrogen, phosphorus, potash, and carbohydrates. Considerable differences were found between the composition of the buds and of the spur proper, the former being higher in percentage of nitrogen, phosphorus, and potash and lower in carbohydrates. In samples collected the middle of June of the off year, buds of the high nitrogen trees contained approximately 2.5 times the nitrogen of the low nitrogen trees. In April of the on year, the differences were comparatively slight. There was a tendency for phosphorus and potash to follow nitrogen. Samples of leaves from the two groups showed higher nitrogen and lower phosphorus and potash percentages in the high nitrogen trees. In the bark of small limbs the high nitrogen trees had more nitrogen, phosphorus, and potash and less total carbohydrates. Summing up, the author concludes that apparently the carbohydrate-nitrogen ratio may be altered within rather wide limits without affecting the fruiting performance of established biennial trees.

Some chemical constituents of the cluster base and secondary vegetative growth of bearing spurs of the Yellow Transparent apple, F. S. Lagassé (*Amer. Soc. Hort. Sci. Proc., 27 (1930), pp. 199–205, fig. 1*).—From 20-year-old trees which had received rather heavy nitrogen fertilization in the 5 preceeding years, bearing spurs were collected in August, stripped of leaves, divided into cluster bases and secondary growths, and subjected to chemical analysis. In general, regardless of fertilizer treatment, the cluster bases averaged higher in percentage of moisture and total, soluble, and insoluble nitrogen, total sugars, free reducing sugars, sucrose, polysaccharides, and total carbohydrates

than did the secondary vegetative growths. On a basis of absolute quantity the cluster base was higher in all these constituents except in one case when starch was less. Comparing cluster bases of trees receiving 20 and 10 lbs. of nitrate of soda, it was found that total nitrogen was 19.3 per cent greater in the 20-lb. trees, whereas in the secondary vegetative growth nitrogen was only 0.37 per cent greater. Soluble nitrogen increases for the 20-lb. trees were 124 and 125 per cent in the cluster bases and vegetative extensions, respectively. Total carbohydrate, as was expected, was higher in the 10-lb. trees, a situation due in the author's opinion to the greater amounts of nitrogen available for combination. The importance of separating the spur into its portions before analysis is emphasized.

Quantitative distribution and seasonal fluctuation of nitrogen in apple trees, A. E. Murneek (*Amer. Soc. Hort. Sci. Proc., 27 (1930), pp. 228–231*).—A brief summary is presented of the nitrogen nutrition situation with relation to fruit trees. On the basis that an 18-year-old apple tree in sod receiving 4 lbs. of ammonium sulfate per year contains from 1.8 to 2.2 lbs. of nitrogen at leaf fall and that the average crop from such trees contains 0.4 lb. of nitrogen, it would appear that annual applications of nitrate of soda or its equivalent at the rate of 0.25 lb. for each year's age of the tree should meet its needs. The author points out, however, that there are several ways in which the nitrogen reserve is depleted—dropping leaves, fruit, and flowers, in prunings, and in the formation of insoluble compounds within the tree. Data by the author and J. C. Logan showed that from 35 to 40 per cent of the total nitrogen of the leaves is reabsorbed by the tree prior to exfoliation. It is believed that from one-third to one-half of the nitrogen reabsorbed by the tree from the falling flowers is deposited in the leaves of the spurs.

The effect of nitrate applications on the soluble carbohydrate in apples, E. F. Hopkins and J. H. Gourley (*Amer. Soc. Hort. Sci. Proc., 27 (1930), pp. 32–36, figs. 7*).—Determinations at the Ohio Experiment Station of total sugars, sucrose, and reducing sugars in the fruits of apple trees subjected to differential nitrogen fertilization failed to show any considerable differences that could be attributed to treatment. In the case of mature Stayman trees in sod there appeared to be a slightly lower concentration in reducing sugars throughout the season in the nitrated trees. Sucrose, from the middle of August to harvest, appeared to be significantly greater in the fruit of the nitrated trees. However, this condition was reversed in the case of young Stayman trees under cultivation, where from the middle of October sucrose was higher in the fruit of the control trees. Tabulated data presented from analyses of fruits from control and nitrated Wealthy trees showed consistently more reducing and total sugars in the control and less sucrose, but the differences were found statistically insignificant, leading to the general conclusion that applications of nitrate had little effect on the soluble carbohydrate content of the fruits.

Soil organic matter as a factor in the fertility of apple orchards, R. D. Anthony (*Pennsylvania Sta. Bul. 261 (1931), pp. 35, figs. 17*).—Asserting the belief that any system of orchard management eventually influences yield mainly to the extent that it modifies the organic content of the soil, the author presents observations made in Pennsylvania orchards on different cultural managements.

In an orchard established at State College in 1908 it was noted as early as the third season that trees under cultivation without cover crops or fertilizer were the poorest in the orchard, and by 1919 this system had to be changed in order to save the trees. Plats receiving annual cultivation with seeded cover crops but no fertilizer failed to grow sufficient ground cover to maintain the soil

organic matter. During periods of drought poor cover crops suffered more severely than those making strong growth, apparently because of the difference in the soil organic matter and its effect on the water-holding capacity. Trees located on plats upon which legumes were grown without fertilizer in general showed but slight decline in growth. Stayman Winesap trees in legume cover crop areas measured 37.9 in. in circumference compared with 35.6 in. for trees in nonlegume areas and at the same time yielded considerably more fruit. Soil in an alfalfa plat was mellow and absorbed water freely, whereas that in a nonlegume plat was hard and puddled after each rain. Manure mulch had to be abandoned on account of mouse damage to trees. Straw mulch supplemented with complete fertilizer greatly increased the nitrate nitrogen of the underlying soil as compared with cultivation and cover crops.

Soil moisture determinations made during the summer of 1929, when less than 3 in. of rain fell from July 1 to September 4, generally showed the least moisture where cover crops were poor. The correlation between previous good cover crops and high moisture was most marked in May and practically disappeared in August, apparently because of the heavy transpiration from the more vigorous cover. Determinations of the moisture-holding capacity of the soil of two contrasting plats showed much higher water-retaining ability for the soil containing abundant organic matter.

Concerning the effects of fertilizer, it was found that nitrogen and potash did not give as good results as did nitrogen and phosphorus, that phosphorus and potash were not materially better than no fertilizer, and that complete fertilizer plats ranked high. Phosphorus had a strong influence on cover crop growth, as shown in more than twice as much cover crop material on nitrogen plus phosphorus areas as on nitrogen plus potash areas. The growth of the cover crop is deemed a more reliable and quicker index to soil fertility than are yield and growth of the trees. Cover crops sowed June 1, 1929, made excellent growth on fertile soils despite drought. Stable manure gave good results except that the resulting growth fire blighted badly, and manure is conceded to be of the greatest value in bringing depleted soils up to a condition capable of growing cover crops. Fertilizer experiments with apple trees in sod showed the importance of supplying nitrogen. However, it was noted that in certain soils capable of producing heavy sod the grass apparently used the nitrates to the detriment of the trees; in fact in one case nitrate of soda up to 25 lbs. per tree failed to supply the needs of both the trees and the grass and led to the recommendation that heavy sods should be turned under every 4 to 6 years.

Removal of spray residues from apples, J. R. NELLER (*Indus. and Engin. Chem., 23 (1931), No. 3, pp. 323–325*).—Observing at the Washington Experiment Station that certain varieties, such as Winesap and Arkansas Black, exuded considerable wax following picking, a fact which greatly added to the task of thoroughly removing spray residues, studies were made of methods of dissolving this wax. Heating the cleaning solution to 38° C. (100.4° F.) had previously been found helpful by softening the wax, but was not always completely effective. Predipping the fruit in a wax solvent bath was found distinctly beneficial in insuring the cleaning of highly waxy and oily apples. Methanol was the most effective of several wax solvents tested. In one case waxy Winesap apples dipped in methanol for 1.5 minutes, followed by washing in 0.1 per cent hydrochloric acid for 1.5 minutes at 20° C., had only 0.0041 grain of arsenic (As_2O_3) per pound of fruit, as compared with 0.015 grain for the hydrochloric acid treatment alone.

Table pears [trans. title], H. FAES, G. LAVANCHY, and P. AUBERT (*Ann. Agr. Suisse, 31 (1930), No. 3, pp. 217–258*).—The results are presented of a study a

Lausanne, Switzerland, of several varieties of table pears, presenting not only descriptive notes but also information on commercial value, susceptibility to diseases, etc.

Effect of light, temperature, and transpiration on elongation of canes of raspberry and other brambles, G. M. Darrow (*Amer. Soc. Hort. Sci. Proc., 26 (1929), pp. 308–311*).—Detailed measurements taken August 5 to September 14, 1927, at the Horticultural Field Station, Glenn Dale, Md., on the elongation of black raspberry canes showed total length gains ranging from less than 1 to 24.6 cm. for the period. Over 85 per cent of the growth was confined to the last 4 cm. of the growing tip, and in no case was more than 1 cm. of the gain back of the 6-cm. point. In 14 of the 27 shoots contractions were recorded in the older portion of the shoot. Auxograph records showed a periodic daily elongation of surprising regularity, presenting two maxima and two minima. Beginning at daylight, gain was quite rapid until 10 to 11 a. m., followed by a slow rate until 1 to 2 p. m., very rapid from 1 to 2 p. m. until 11 p. m., and moderate from thereon until daylight. The ratios expressed mathematically were 60, 20, 100, and 35, respectively.

Apparently the rate of growth was not directly correlated with light; in fact, observations on one cane over a 12-day period showed an average of 19.6 cm. for day and 18.4 cm. for night. High transpiration is conceded a probable cause of the midday deceleration, afternoon resumption being deemed the result of restored turgor following the closure of the stomata. Growth into the night is believed associated with an accumulation of photosynthetic products and growth cessation at midnight to the exhaustion of these products. The fact that growth never ceased is evidence that turgor was never completely lost.

The rôle of temperature in growth was shown in the fact that no elongation occurred on nights when the temperature fell below 40° F. On the other hand, temperatures of 90°+ did not inhibit elongation. Temperature with its one maximum and one minimum daily could not be correlated directly with growth behavior. Species differed in their growth response to low temperature, forms of known hardiness ceasing elongation first.

Carbohydrate composition of Dunlap strawberry plants, H. W. Richey and C. E. Asbury (*Amer. Soc. Hort. Sci. Proc., 27 (1930), pp. 179–183, figs. 2*).—Utilizing as material Dunlap strawberry plants carefully selected as to uniformity and allowed to form only five unbranched runners, analyses were made at the Iowa Experiment Station at frequent intervals of the mother plants and of the stolon plants grouped according to their age. In all cases the flower buds were not included. In 1927 the crowns and roots were taken as a unit, and in 1928 they were analyzed separately.

Monosaccharides were found quite constant in 1927, with a tendency to be a little more abundant in the younger plants. In 1928 with plants divided into crowns and roots, monosaccharides decreased sharply in the crowns in late September and early October. In the roots there was a distinct tendency for the high percentage of monosaccharides to vary outward with the season until on October 25 the sixth series of runner plants contained the highest percentage. In 1927 disaccharides were slightly greater but more variable than the monosaccharides. In 1928 disaccharides increased rapidly in the crowns and roots of the younger plants during the latter part of the growing season, apparently following a check by low temperature. Polysaccharides increased in 1927 as the season advanced, the percentage decreasing outwardly from the mother to the youngest plants. This accumulation of polysaccharides was the most pronounced change in carbohydrate composition. In general the mother and the oldest progeny plants were larger, more mature, and contained the larger reserves, and hence were probably more valuable for production.

Miscellaneous tropical and sub-tropical Florida fruits, H. MOWRY and L. R. TOY (*Florida Sta. Bul. 223 (1931), pp. 88, figs. 75*).—In connection with a general discussion of temperature requirements, methods of propagation, and of culture, a large number of tropical and subtropical fruits are described, with notes on cultural and propagation requirements and on the use of the fruits.

Sap concentration and inorganic constituents of mature citrus leaves, A. R. C. HAAS and F. F. HALMA (*Hilgardia [California Sta.], 5 (1931), No. 13, pp. 407–424, figs. 11*).—Using the freezing point depression method as a measure of sap concentration and supplementing the observations with chemical analyses for various inorganic constituents, such as potash, magnesium, and calcium, a study was made of the mature leaves of the Eureka lemon and Navel and Valencia oranges collected at intervals of from 4 to 6 weeks throughout the year. Checking the results of sap concentration determinations with meteorological records, it was found that neither sunshine nor humidity bore any relation to sap concentration changes but that air and soil temperature curves did show a striking inverse relationship to sap concentration data. Concerning species, the sap of lemon leaves was consistently more dilute than that of oranges, but the seasonal fluctuations coincided. The content of the various inorganic constituents of dried leaves and of the sap apparently was more closely related to the age of the leaves than to environmental changes. Indications were observed that a new growth cycle draws on the inorganic supply of the subtending growth cycle.

The use of acetaldehyde in the storage of fruit, S. A. TROUT and R. G. TOMKINS (*Jour. Council Sci. and Indus. Research [Aust.], 4 (1931), No. 1, pp. 6–11*).—Having observed that acetaldehyde in concentrations sufficient to prevent mold growth caused no injury to the fruit, an experiment was carried out in which sound, injured, and inoculated oranges were stored at 10° C. (50° F.) in desiccators the atmospheres of which contained acetaldehyde in concentrations ranging from 1 to 200 to 1 to 1,000. Mold attack was checked by the 1 to 500 concentration and completely inhibited by the 1 to 250 concentration, but the latter caused considerable browning of the fruits. Grapes, even when punctured by a needle, kept without molding for 21 days in a 1 to 1,000 concentration of acetaldehyde and only 3 days in air. Good results were secured with strawberries, raspberries, and cherries in the 1 to 1,000 concentration. Dipping fruits in acetaldehyde solution gave negative results. Commercial application of the treatment is said to be dependent on the development of devices for introducing and maintaining the acetaldehyde in the storage atmosphere.

Factors influencing fruit setting in the pecan, G. W. ADRIANCE (*Bot. Gaz., 91 (1931), No. 2, pp. 144–166, figs. 6*).—A cytological study of the process of fertilization of the pistillate pecan flower, the botanical structure of which is described in detail, showed that the pollen tube grows down through the style and ovary wall to the base of the ovule and returns through the chalaza and nucellus to the embryo sac, where fertilization occurs about four weeks after pollination. The extensive dropping of young nuts occurring about four weeks after pollination is ascribed to a lack of fertilization. No evidence of self or interincompatibility was observed, good sets of nuts being obtained from receptive flowers irrespective of the variety of pollen applied. The periods of maturity of staminate and pistillate flowers did not often coincide, sometimes the pistils being receptive before the pollen was ripe and sometimes the reverse being true. Moore, Alley, Texas Prolific, and San Saba were protandrous every season, and others Moneymaker, Bolton, and Success, were usually protogynous.

It is recommended that trees of some of the early maturing pollen group be included in every pecan orchard to insure pollination. Moisture and high temperature apparently favored early maturity of the staminate flowers, and cool, dry seasons the early maturity of the pistillate blooms.

FORESTRY

The growth of jack, Norway, and Scotch pine plantations on Hinckley loamy fine sand, J. H. Allison (*Jour. Forestry, 29 (1931), No. 3, pp. 381–383*).—Measurements taken in 1928 in plantations established in 1918 on light sandy soil near St. Paul, Minn., which previously had supported a light stand of scrubby oak, showed an average mean annual height growth of 1.14, 0.774, and 0.538 ft. for jack, Scotch, and Norway pines, respectively. The average annual precipitation for the 10 years was 26.06 in. Apparently the soil, considered submarginal as concerns general agriculture, could be profitably utilized for growing these species.

Notes on growth of slash pine in Texas, C. B. Webster (*Jour. Forestry, 29 (1931), No. 3, pp. 425, 426*).—Slash pines planted in 1926 when from 8 to 10 in. tall averaged 8.92 ft. in January, 1931, and had an average diameter at breast height of 1.66 in. for all trees over 5 ft. Thus for each 1.87 ft. in height there was 0.5 in. of diameter growth. Temperatures as low as 5° F. did not injure the trees after one year in the plantation. The value of the tree as a source of pulp is suggested.

Trees for Wyoming farmers and ranchmen (*Wyoming Sta. Circ. 24 (1931), pp. 4*).—This pamphlet contains information on methods of planting, culture, and desirable species, and upon stock available for distribution under the provisions of the Clarke-McNary Act.

Successful storage of longleaf pine seed, P. C. Wakeley (*Jour. Forestry, 29 (1931), No. 3, pp. 424, 425*).—Tests conducted by the Southern Forest Experiment Station showed that longleaf pine seed, stored at low temperature in tight containers, may be held for one year if not longer. In general, the tighter the vessel the better the results. Cold storage seed germinated equally as rapidly as fresh seed. As a practical deduction it is suggested that thoroughly dry seed be placed in tight cans and held at from 32 to 35° F.

Pine-tree treasures, N. Owen (*U. S. Dept. Agr., Misc. Pub. 106 (1931), pp. II+14, figs. 11*).—A popular account of the practices and methods employed in the naval stores industry.

Home grown timbers—their anatomical structure and its relation to physical properties: Elm, S. H. Clarke (*[Gt. Brit.] Dept. Sci. and Indus. Research, Forest Prod. Research Bul. 7 (1930), pp. VI+27, pls. 12, figs. 7*).—The anatomical structure of the second wood of *Ulmus campestris*, *U. major*, and *U. montana* is described, and the range of variation in the material under examination is given in the form of tables and graphs. The maximum size of the elements is greatest in *U. major* and least in *U. montana*. During the youthful period the elements become progressively larger; in the adult period their size is relatively constant. Wood formed in youth is generally denser than wood formed during the adult period, irrespective of ring width.

The relations existing between structural features are usually complicated, as in the case of ring width and the proportion of summer wood. A simple relation, however, exists between specific gravity and fiber volume. The relations between strength and specific gravity and between strength and fiber volume are of about the same order. The correlation coefficient in each case is low ($+0.279\pm0.096$ and $+0.266\pm0.096$ in *U. major*). The correlation between

strength and the proportion of fiber wall is somewhat closer (+0.349±0.103 in *U. major*), and between strength and the combined proportions of primary and secondary walls is closer still (+0.436±0.085 in *U. major* and +0.572±0.09 in *U. montana*).

DISEASES OF PLANTS

[Plant pathology at the New Mexico Station] (*New Mexico Sta. Rpt. 1930, pp. 54, 55, 62*).—In the case of irrigated chili pepper plants grown under level culture and on ridges, a considerably higher percentage of wilt loss occurred under level culture, being apparently associated with soil moisture content, which was somewhat less on the ridges. The causal fungus could not be found on the seed, leading to the deduction that it is not seed borne.

In a study of the apple measles disease, growth of an indetermined fungus was obtained in 80 per cent of the plated cultures made up from Jonathan wood in various stages of the development of measles.

Further evidence was obtained that aluminum sulfate has value as a remedy for chlorosis of fruit trees.

Some cytological phenomena in disease-resistant plants, J. Dufrenoy (*Phytopathology, 18 (1928), No. 1, p. 144*).—Certain species of Phytophthora live primarily in meristematic tissues in the cambial regions of roots and stems. The entrance of the invading tips of the hyphae into any part of the cambial tissue causes cells at some distance away to divide in a transverse plane and to form a pathologic cambial layer. This layer consists of two types of cells as follows: (1) Those on the side away from the infected tissues, containing large nuclei, dense cytoplasm, and mitochondria; and (2) those on the side toward the infected tissues, soon developing large vacuoles which accumulate tannoid compounds, fuse, and crowd the cytoplasm and nuclei to the peripheries of the cells. If the fungus grows rapidly enough to invade the meristematic cells of the pathologic layer, it will continue to thrive, deriving its food from the cells and at the expense of their vital activity. If the fungus fails to penetrate the pathologic layer before the cells have developed large vacuoles containing tannic compounds, it can not obtain food and starves, and in this way the extension of the lesion is checked.

Longevity of Pseudomonas tumefaciens Sm. & Town. in various soils, M. K. Patel (*Phytopathology, 18 (1928), No. 1, p. 129*).—Clay, loam, and quartz sand, sterilized and then artificially inoculated with *P. tumefaciens*, yielded reisolations after 16 months, without a decrease in the number of colonies in the case of loam and clay, though a decrease as time increased occurred in a number of colonies on agar poured plates of crystal violet bile.

Pure cultures were obtained from nonsterilized infested sand after 16 months and from clay and loam after 14 months. This difference in decrease in longevity may have been due to a greater competition with soil bacteria in the loam and clay. Both unsterilized and sterilized loam kept in the open from October to March yielded virulent cultures of the pathogene. Samples of unsterilized and sterilized infested clay, loam, and quartz sand, buried 12 in. in the soil from November to March, gave pathogenic cultures of the crown gall bacteria. Field soils of the loam type infested in the late fall with a 72-hour broth culture of the pathogene and finely chopped tomato galls yielded the pathogene the following March.

Strains of Pseudomonas tumefaciens Sm. and Town. and their prevalence in various soils, M. K. Patel (*Phytopathology, 18 (1928), No. 1, pp. 129, 130*).—In further studies, carried out as described on 15 nonpathogenic strains and 1 to several pathogenic strains of *P. tumefaciens*, the pathogenic

strains always, the nonpathogenic strains never, produced crown galls on sweet peas, garden peas, oleander, bryophyllum, raspberries, weeping willows, and apples. One pathogenic strain, identical in all other respects with the other pathogenic strains, lost its virulence after being cultured for 2 years on common medium.

Plates from various soil samples were poured, using the author's crystal violet bile medium, and from 41 of the 96 samples collected from 12 nurseries in 9 States organisms resembling *P. tumefaciens* were obtained, 7 of which proved pathogenic on tomato plants. From another lot of 14 samples taken from pasture and corn land, virgin prairie, and nursery fields on which no crown gall susceptible crops had been grown for many years, only 1 nonpathogenic colony which resempled *P. tumefaciens* was obtained. Repeated isolations from water and air gave no colonies resembling *P. tumefaciens*.

Seed disinfectants for the control of covered smut and stripe of hulless barley, R. H. Porter (*Phytopathology, 18 (1928), No. 1, p. 139*).—In extensive experimentation at Nanking, China, in 1925 and 1926 with seed disinfectants for the control of covered smut and stripe of hull-less barley, the liquid treatments used were Tillantin B and Uspulun 0.3 per cent solutions, cold formaldehyde, and hot formaldehyde, and the dry treatments were copper carbonate, Tillantin B, Uspulun, and powdered copper sulfate. In 1925, all treatments reduced the covered smut to less than 0.5 per cent in rod rows, the checks having 7 per cent. In rod-square plats the checks had 27 per cent of smut, those receiving copper carbonate (54 per cent) showing 1.2 per cent. In 1926, copper carbonate and dry Uspulun eliminated smut entirely. Dry Tillantin B gave 0.87 per cent, the checks averaging 6 per cent. The percentage increases in yield due to copper carbonate, Uspulun, and Tillantin B were 15.4, 12.4, and 20.7 per cent, respectively, the checks yielding 13 bu. per acre. Plantings were in rod rows with 9 replications. Copper carbonate, Uspulun dust, and Tillantin dust used on stripe-infected seed lowered the attack from 10.8 per cent in the checks to 5.5, 4, and 4 per cent, respectively, the yield increases being 10, 9.6, and 10 bu. per acre.

A preliminary method of measuring the relative efficiency of seed corn disinfectants, W. P. Raleigh (*Phytopathology, 18 (1928), No. 1, p. 140*).—In a method outlined as of value in ascertaining desirable or undesirable concentrations or dust combinations, treatments were made on seed corn units of 15 kernels each, placed in crystallizing dishes (10 by 5 cm.), and covered with 4 cm. of washed sand, an equal amount of water being added at that time and later as necessary, and the cultures being placed in the laboratory at from 22 to 25° C. or in the greenhouse at from 16 to 20°. Both diseased and nearly disease-free seed were tested in this way. The advantages of the method are outlined.

New dust treatments for oat smuts, J. D. Sayre and R. C. Thomas (*Phytopathology, 18 (1928), No. 1, p. 139*).—Of two new dust treatments for the control of the smuts of oats which were tried the previous summer with excellent results, one, made by mixing formaldehyde with infusorial earth in different concentrations, gave as good oat smut control when used at the rate of 3 oz. a bushel of grain as did the wet-formaldehyde method, allowing less than 0.2 per cent smut, the checks averaging 47 per cent smut. In the case of the other dust, made by mixing finely ground solid iodine with infusorial earth, it was found that the iodine is quickly vaporized at ordinary temperatures and diffuses through the infusorial earth and is absorbed by it, and when this was used at the same rate as the formaldehyde dust only three smutted heads of oats were found in the 3 0.01-acre plats. No injury resulted

from either treatment. The cost of treating is estimated at less than 5 cts. per bushel.

New physiologic forms of Tilletia tritici in wheat, E. F. Gaines (*Phytopathology, 18 (1928), No. 1, p. 139*).—In 1927 bunt appeared on hitherto immune strains of wheat at five different stations in Washington, Oregon, and Montana. An experiment testing the pathogenicity of *T. tritici* from Germany in comparison with that from eastern Washington showed the American wheats to be much more susceptible to the German form and the German wheats to the American form. Inoculation tests in Europe showed the so-called immune American wheats to be sometimes subject to attack there.

It is thought that the recent gradual increase of bunt in America (Kansas, Virginia, and Pennsylvania) may be due to newly introduced and more virulent forms of the smut.

Biometrical studies on the variation of physiologic forms of Puccinia graminis tritici and the effects of ecological factors on the susceptibility of wheat varieties, M. N. Levine (*Phytopathology, 18 (1928), No. 1, pp. 7–123, pl. 1, figs. 37*).—In this presentation of results from investigations made in cooperation with the Bureau of Plant Industry, U. S. D. A., and the Minnesota Experiment Station, an account is given of the work at a series of uniform rust nurseries at various experiment stations in the United States and western Canada, numbering in all 34 for the years 1919–1923, the maximum number of wheat and emmer varieties tested in any year being 24.

In general, Acme, Monad, Pentad, and Kota seemed to withstand the attack in the field. Khapli was always highly resistant, and Vernal practically always so, the other varieties being susceptible in varying degrees. Though exceptions are indicated, the varietal reaction was the same in a given field nursery as in the greenhouse. Nearly all the hard red spring wheats were susceptible to the prevailing physiologic forms. The durums, though differing, showed lower infection percentages than did Marquis or the common wheats. Of 78 rust collections studied, 20 consisted of 2 forms each, and one yielded 3 forms.

Other conditions being equal, the uneven quantitative distribution of rust inoculum is a factor in the severity of infection on naturally susceptible varieties. Maturity and general condition at the time of infection are factors, as also are soil type, topography, fertilization, mean temperature during the last two months of the growing season, and weather elements generally. *Berberis vulgaris* may breed, as well as propagate, virulent physiologic forms of stem rust. The parasitism of the physiologic forms of *P. graminis tritici* is only slightly and temporarily affected by external conditions. Extensive experimentation has not borne out the claim that these forms originate through progressive adaptation to changing environment. Mutation, hybridization, and anastomosis are being extensively studied. Resistant varieties offer a means of defense, both feasible and effective. Early maturing sorts, rotations, fertilization methods, and chemical remedies present themselves as hopeful aids.

The reaction and treatment of soils infested with Plasmodiophora brassicae Wor., F. L. Wellman (*Phytopathology, 18 (1928), No. 1, pp. 14[illegible]–142*).—As bearing upon the common view that clubroot of crucifers depends primarily on the presence of an acid soil reaction, which, if neutralized, tends to reduce the amount of the disease, laboratory and field studies have shown that increase of pH alone is not effective in inhibiting this disease, as the amounts of different neutralizing substances required to inhibit the disease seem to depend upon the choice of reagents rather than the effect on pH. The pH was varied experimentally to alkalinity well above the high point found in naturally infective soils without reducing the severity of attack. Treatment

of soils with lime showed that 2 tons of calcium hydrate per acre gave practical commercial control of clubroot. Air-slaked lime, though usable, was unsatisfactory. Raw limestones, marls, and gypsums proved ineffective.

The use of selection and selfing in improving Iacope cabbage, I. E. Melhus and D. R. Porter (*Phytopathology, 18 (1928), No. 1, p. 142*).—A strain of the yellows-resistant cabbage Iacope, developed by selection and self-pollination, proved immune when grown on severely infested soil in 1927. This strain, designated as 15–23–2–S1–S1–S1, was severely tested for yellows resistance during three growing seasons, and in 1927 the 159 plants all proved resistant. The selected strain also shows other characters, which are described, of a good early cabbage.

A Fusarium-resistant cabbage of Jersey Wakefield type, J. C. Walker and F. L. Wellman (*Phytopathology, 18 (1928), No. 1, p. 142*).—In view of a growing need in certain yellows-infested areas for an early-maturing resistant cabbage of the pointed head type, initial selections were made in 1925 from surviving heads of the Jersey Wakefield variety on infested soil, and these were allowed to seed in the greenhouse during the following winter. Of the progenies as tested in 1926, all segregated in the approximate ratio of 3 resistant to 1 susceptible. Selections were made from progenies of 4 original plants grown to seed in 1926–27, and in 1927, from 12 selfed progenies tested, 6 were secured which were homozygous for resistance, all showing a complete stand of healthy plants. The remaining 6 progenies again segregated at approximately 3 resistant to 1 susceptible. The results confirmed earlier evidence that Fusarium resistance in cabbage is a single dominant Mendelian character. From the homozygous resistant families of 1927 several were selected for multiplication. These are typical of Jersey Wakefield in all important characters, including earliness.

Aphis transmission of cucumber mosaic, S. P. Doolittle and M. N. Walker (*Phytopathology, 18 (1928), No. 1, p. 143*).—Experiments regarding the transmission of cucumber mosaic by *A. gossypii* show that this aphid, if allowed to feed for five minutes on a mosaic plant, can then transmit the disease by feeding for the same period on a healthy plant. The aphid loses its capability to transmit mosaic soon after first feeding on a healthy plant, with no evidence of injury to the aphid. It is thought that the virus is carried on the proboscis and so is exhausted during the early part of the feeding period. Aphids from mosaic plants transmit no disease after from 6 to 8 hours' confinement in a test tube, approximately the period during which the mosaic cucumber juices remain infectious.

Further evidence of resistance to cucumber mosaic in the Chinese cucumber, R. H. Porter (*Phytopathology, 18 (1928), No. 1, p. 143*).—In July, 1927, 200 Chinese Long and 50 White Spine cucumber plants were inoculated in the greenhouse with the virus of cucumber mosaic, two weeks after which all were transplanted in the field and placed under observation throughout the summer. No Chinese plants showed mosaic, but in White Spine 75 per cent developed the disease. In the same field White Spine plants developed mosaic due to natural infection to the extent of about 50 per cent. Of the plants of the Chinese variety raised from seed in the same field, none developed mosaic symptoms.

Fusarium attack on onion seeds [trans. title], K. Tomsa (*Ochrana Rostlin, 8 (1928), No. 5, pp. 105–112, fig. 1; Fr. abs., pp. 111, 112*).—In seed of onion cultivated in France, the author found a strong internal infection. This apparently was caused by *F. cepae*, of which, as of the effects, a descriptive discussion is given.

A new and destructive disease of the potato in Utah and its relation to the potato psylla, B. L. Richards (*Phytopathology, 18 (1928), No. 1, pp. 140, 141*).—A new and rapidly spreading potato disease showed itself in destructive form in Utah, appearing also in southern Idaho, Montana, and Wyoming. The early crop was most severely affected. The developments are described.

The potato psylla (*Paratrioza cockerelli*) was found in association with diseased plants, and experimental work showed the disease to be caused in some way by the nymph of this insect, all the various symptoms having been produced under controlled conditions in the greenhouse. The yellow appearance featuring the disease in all the varieties of potatoes so far studied suggests the name yellows.

The properties and behavior of potato rugose mosaic, J. Johnson (*Phytopathology, 18 (1928), No. 1, p. 141*).—With a view toward more satisfactory descriptions and classifications of potato virus diseases, the determination of the properties of certain viruses was undertaken. Some of these properties are reviewed.

Transmission of potato spindle-tuber by grasshoppers (Locustidae), R. W. Goss (*Phytopathology, 18 (1928), No. 1, p. 140*).—Since aphids are not supposed to be numerous enough in the potato sections of western Nebraska to account for the occasionally observed rapidity of spread, tests were made with other insects common in the potato fields. In 1925, out of 36 inoculations with grasshoppers (1 to 10 in each test) 8 resulted in typical spindle tuber. In 1926, 64 inoculations gave 29 infections. Larger numbers of insects and repeated inoculations increased infections. Uncaged control plants remained healthy. From the results indicated it was thought that some grasshoppers were viruliferous when collected.

A preliminary report on the relationship of insect carriers to the development of tip and margin burn of Irish potatoes, H. R. Rosen (*Phytopathology, 18 (1928), No. 1, p. 141*).—Screening of potatoes during growth shows a marked correlation with the increase in growth under the conditions. Preliminary work appears to indicate that control of insects, particularly of leafhoppers, is at least one factor in these differences. Plants partly covered with screens showed the same amount of burning at the tip and margin as did the unscreened plants. Plants partially covered with wooden slats showed no superiority over unshaded ones.

The toxic substance produced by the eye-spot fungus of sugar cane, Helminthosporium sacchari Butler, A. Lee (*Plant Physiol., 4 (1929), No. 2, pp. 193–212, figs. 2*).—Sugarcane eyespot, characterized varietally by small leaf spots and long streaks, and caused by *H.* (*Cercospora*) *sacchari*, may kill even as high as 80 per cent of the stalks.

The study here systematically presented gave negative results when tests were conducted for a toxic reaction of susceptible sugarcane leaves with filtrates of cultures of the fungus in pure sucrose solutions and in beef extract bouillon media. Tests on sugarcane leaves with filtrates of the fungus in Richard's solution indicated a toxic substance which persisted after heating.

Evidence points to a toxic substance, not as a direct product of the fungus metabolism, but as a product of the environmental medium. The fungus showed capacity to reduce to nitrites some of the lower nitrogen compounds in its environmental medium, and these nitrites revealed a toxicity to the host tissues, notably in chlorophyll reduction.

The results are said to indicate a strong relationship between the virulence of this disease, and also supposedly of many other plant diseases, and the nitrogen nutrition of the host. An attempt to apply these results in commer-

cial crop production by using organic nitrogen fertilizers with the host plants depends for its success upon the nitrogen reaching the leaves in a form other than that of nitrates. Field results with organic nitrogen fertilizers in eye-spot disease of sugarcane indicate an increase of the disease as large as that which follows the use of inorganic nitrogen fertilizers. "The logic of the results recorded in this paper, as well as of the field results, does not therefore indicate that applications of organic nitrogen fertilizers will serve as a control measure for this disease."

A way has been developed for minimizing this disease which depends on avoiding nitrogen fertilizers during climatic conditions favoring fungus infection. Nitrogen fertilizers of any class should be applied at a time when the host will react to the nitrogen in a period having climatic conditions unfavorable to infection. This procedure is said to have been notably successful in actual practice against sugarcane eyespot disease.

Some virus diseases of tobacco in Kentucky, W. D. Valleau and E. M. Johnson (*Phytopathology, 18 (1928), No. 1, pp. 132, 133*).—From tobacco in Kentucky four supposedly distinct strains of true tobacco mosaic have been obtained. Virus diseases of tobacco, distinct from mosaic, are indicated as to forms, hosts, and possible relations or even identities. Though not so prevalent as tobacco mosaic, the other virus diseases are thought to spread as rapidly by natural means and to be equally injurious.

Soil reaction and black root rot of tobacco, P. J. Anderson (*Phytopathology, 18 (1928), No. 1, p. 131*).—It is stated that though black root rot (*Thielavia basicola*) is present in all old tobacco fields of whatever reaction in the Connecticut Valley, severe reduction in yield occurs only in those soils which are near the neutral point. Black root rot injury in fields below pH 5.6 is negligible, but practically all old fields about pH 6.0 are suffering from the disease in such a way that the higher the reaction the smaller the growth. Between pH 5.6 and 6.0 injury may be absent or present in varying degrees, as determined by other characters of the soil and the season. A rapid soil-testing technic, which has been developed, is now being used each year in choosing fields suitable for tobacco.

The influence of cropping systems and fertilizers on black and brown root rot of tobacco, J. P. Jones (*Phytopathology, 18 (1928), No. 1, p. 131*).—Though different cropping systems have not affected tobacco black root rot, they have influenced the brown rot to extents determined by the other members of the rotation. In the animal husbandry rotation, tobacco after hay or corn gave lowered yields due to brown rot. Tobacco after onions or potatoes, or in continuous culture without a cover crop, was but little injured by brown root rot. Timothy as a cover crop favored brown rot and so reduced the yield. Tobacco grown every year on the same land and without a cover crop showed the least injury by brown rot and the best yields.

Black root rot does no damage on soils more acid than pH 5.95, but reduction below this point due to liming started the injury. Phosphoric acid also stimulated black root rot in badly infested soil, but not when it was already acid. Carbonate of potash in quantity needed by tobacco, when applied to acid soils, did not influence black rot. Brown root rot has not been proved to be affected by fertilizers.

See also a previous note (E. S. R., 63, p. 524).

Studies with the watermelon wilt, caused by Fusarium niveum E. F. S., D. R. Porter (*Phytopathology, 18 (1928), No. 1, pp. 143, 144*).—*F. niveum* may enter the host through root hairs, wounds, and epidermis of the hypocotyl, producing well-defined symptoms, which are described, with data as to media, growth, and viability.

Infection in the field is most rapid when seeds are planted about 0.5 in. above the inoculum, but slight when the positions are reversed.

Varietal resistance of watermelons to wilt (Fusarium niveum E. F. S.), D. R. PORTER (*Phytopathology, 18 (1928), No. 1, p. 144*).—In 1926 and 1927, 52 watermelon varieties, 9 African forage melon strains, the preserving citron, and 13 Chinese melon strains were tested for wilt resistance on severely infested land in Iowa. All the commercial varieties tested proved very susceptible, infection varying from 75 to 100 per cent. The Conqueror appeared to be the most resistant, living about three weeks longer than the other varieties, among which susceptibility seemed to vary with soil, moisture, and temperature conditions.

Four of the 13 Chinese selections showed, in 1927, resistant percentages of 25, 28, 29, and 39, respectively, the commercial varieties used as controls showing 100 per cent infection. The preserving citron proved to be 82 per cent resistant in 1927. Two African forage melons appeared to be immune. First generation hybrids appeared to be as susceptible as the susceptible parent, resistance in the F_2 generation varying with the resistant parent. African hybrids are much more resistant in the F_2 generation than are Conqueror hybrids.

The cycle of infection in apple blotch, E. J. KOHL (*Phytopathology, 18 (1928), No. 1, p. 145*).—In an experimental block of 60 young Duchess apple trees at Vincennes, Ind., in which cankers have been excised since 1922 and blotch sprays have been withheld from 1925 to 1927, counts of petiole infection were made in August, 1927, and the origin of infection determined. On 37 trees which showed infection and on which 12,330 leaves were examined, no infection was traced to cankers on 1926 wood, infection on 1,615 leaves was traced to 72 cankers on 1925 wood, no infection was traced to 2 cankers on 1925 wood, infection on 35 leaves was traced to 6 cankers on 1924 wood, and no infection was traced to cankers on 1923 or 1921 wood, of which 2 each were found present. The cycle of infection is indicated as at least 2 years in length.

The use of potted trees showed that infection at La Fayette, Ind., occurred during 18 out of 27 rain periods between 3 days and 7 weeks after petal fall (May 7). At Mitchell, Ind., in 1927 infection occurred during 15 out of 17 rain periods between 5 days and 6 weeks after petal fall (April 25).

Bateriophage of Bacterium pruni, H. W. ANDERSON (*Phytopathology, 18 (1928), No. 1, p. 144*).—Soil beneath infected peach trees yielded a bacteriophage of high potency, though 10 successive filtrations were required to insure the clearing of turbid cultures. A stock supply capable of clearing turbid suspensions of *B. pruni* when diluted to 10^{-6} or even to 10^{-10} was finally obtained. Typical plaques were obtained with high dilutions on agar plates, but secondary cultures almost always developed later.

Pythium aphanidermatum (Eds.) Fitz. on Opuntia dillenii, Haw., T. S. RAMAKRISHNA AYYAR (*India Dept. Agr. Mem., Bot. Ser., 16 (1928), No. 7, pp. 191–201, pls. 5*).—From diseased and rotting plants of *O. dillenii* in pots there was isolated the fungus *P. aphanidermatum*, which was proved by inoculation experiments to be pathogenic on Opuntia, also on other plants. The growth of the fungus on culture media was studied. It is claimed that *P. butleri* is a strain of *P. aphanidermatum*.

A new view of the causation of Diplodia disease, C. H. GADD (*Tea Quart. [Tea Research Inst. Ceylon], 1 (1928), No. 4, pp. 89–98, pls. 2*).—Observations are offered in support of the view that the nearly complete removal of the leaves of a tea plant at a time when little or no starch reserve is present pre-

vents normal recovery of the plant, and may even prove disastrous. Manures can not remedy the situation, as the bush can not make good any deficiency of reserve food as long as it lacks leaves.

"The most obvious method of enabling the bush to build up a reserve is by resting it. The time necessary for the manufacture and storage of food in sufficient quantity for growth requirements after pruning is at present unknown."

Suggestions regarding treatment are offered tentatively, the main object of this article being to draw attention to the importance of internal food reserves at pruning time.

It is thought probable that several distinct diseases are known by the name Diplodia. Some of these are discussed in the present article.

The treatment of the Poria root disease, C. H. Gadd (*Tea Quart.* [*Tea Research Inst. Ceylon*], *2* (*1929*), *No. 1, pp. 16–21, pls. 2*).—Of the parasitic root diseases of the tea plant, that due to ***P. hypolateritia*** is said to be the commonest and the most difficult to eradicate, the bare areas in fields being often the direct result of the advance of this organism and a fair measure of the time during which it has been active. Protective measures are indicated.

Transportation should employ closed sacks. The first step in treatment should be removal and destruction of all diseased material. Isolation trenches should be 2 ft. deep, and removed earth should be thrown on the inclosed area. Where trenches can not be made, a bare zone must be established around the infected area. The fungus may exist for as much as a year in soil without tea roots to live upon. To destroy the disease fungus left in uprooting, it is necessary that the sterilizing chemicals reach a depth of at least 2 ft., but not in sufficient strength to inhibit the future growth of tea. Lime, in the quantities frequently used, may promote rather than destroy the growth. "Reduced growth increments resulted from the additions of sulfur."

Pruning in relation to wood rot of tea, C. H. Gadd (*Tea Quart.* [*Tea Research Inst. Ceylon*], *2* (*1929*), *No. 1, pp. 10–16*).—A brief but comprehensive discussion regarding the exposures and liabilities arising in pruning operations emphasizes the importance of making only clean wounds in situations as advantageous as possible, of avoiding the more disadvantageous seasons for this work, and of affording efficient protection at the points of unavoidable injury. "The larger the wound and the slower the reparative process, the more important becomes the wound dressing."

Preliminary report on a new leaf spot of pecan, O. C. Boyd (*Phytopathology, 18* (*1928*), *No. 1, pp. 133, 134*).—There was observed in 1926 a characteristic leaf spot in pecan orchards near Albany, Ga., and in 1927 in practically every pecan section surveyed in the southern part of the State this characteristic and supposedly new leaf spot. The order of varietal susceptibility appears to be Delmas, Moneymaker, Stuart, Frotcher, Van Deman, Schley, Alley, and Mobile. The common varieties not attacked include Moore, Success, Tesch, and Pabst. The trees are injured by premature, partial defoliation.

The causal organism, though resembling somewhat both Cylindrosporium and Cercosporella, does not appear typical of either.

Foot-rot and wilt of antirrhinums caused by Phytophthora pini var. antirrhini, n. v., S. Sundararaman and T. S. Ramakrishnan (*India Dept. Agr. Mem., Bot. Ser., 16* (*1928*), *No. 3, pp. 83–100, pls. 7, figs. 2*).—A fungus isolated from antirrhinums showing collar rot, as reported from the Botanic Gardens, Ootacamund, and as grown on various media and used for inoculation, is considered as a new variety and named *P. pini antirrhini*.

A new Heterosporium parasitic on Iris germanica [trans. title], G. Nicolas and Aggery (*Rev. Path. Vég. et Ent. Agr., 15 (1928), No. 3, pp. 63–66, figs. 20*).—In 1927 the authors observed on leaves of *I. germanica* a disease which is discussed in association with a fungus here described as the n. sp. *H. pruneti*.

ECONOMIC ZOOLOGY—ENTOMOLOGY

A text-book of economic zoology, Z. P. Metcalf (*Philadelphia: Lea & Febiger, 1930, pp. X+17–392, figs. 236*).—The chapters of this work deal with the Mammalia and their economic importance (pp. 17–51), the birds in relation to man (pp. 52–113), the Reptilia (pp. 114–138), the Amphibia (pp. 139–148), the fishes and fisheries industry (pp. 149–171), the Arthropoda in general (pp. 172–189), the spiders, scorpions, ticks, mites, millipeds, and centipeds (classes Arachnida and Myriapoda) (pp. 190–207), the insects in relation to man (pp. 208–274), the segmented worms (pp. 275–278), the Mollusca and the shell-fish industry (pp. 279–292), the echinoderms (pp. 293–300), Phylum Nemathelminthes (pp. 301–310), the flatworms and some important animal parasites (pp. 311–327), some animals of uncertain relationship or of little economic importance (pp. 328–339), the sponges and sponge fishing (Phylum Porifera) (pp. 340, 341), and the Protozoa and protozoal diseases (pp. 342–353).

Wild animals of North America, E. W. Nelson (*Washington, D. C.: Natl. Geogr. Soc., 1930, rev., pp. [8]+254, pl. 1, figs. 203*).—This is a revised edition of the work previously noted (E. S. R., 40, p. 646).

Information for the guidance of field men and cooperators of the Bureau of Biological Survey engaged in the control of injurious rodents and predatory animals, P. G. Redington and S. P. Young (*U. S. Dept. Agr., Misc. Pub. 115 (1931), pp. 8*).—A discussion is given of the necessity for the control of wild animal pests, control functions of the Bureau of Biological Survey, and legal authorization for control work. Under the headings of animals on the control program, the injurious rodents, the predatory animals, and other forms subject to control are considered. Instructions regarding field practices take up the objective; conservation, State laws, and cooperation; precautions in handling poisons; rodent control operations; and predatory animal control.

The muskrat, J. Ulbrich (*Die Bisamratte. Dresden: C. Heinrich, 1930, pp. 137, pls. 48, figs. 5*).—An account is given of the anatomy, biology, occurrence in Europe, agricultural importance, and combat of the muskrat (*Fiber zibethicus* L.). The appendixes include the ordinances and organization relating to its control in the Prussian Provinces, a tabular summary of the number killed in Saxony in the years 1925, 1926, and 1927, etc., and a bibliography of 10 pages.

Habits of the short-tailed shrew, Blarina brevicauda (Say), W. J. Hamilton, Jr. (*Ohio Jour. Sci., 31 (1931), No. 2, pp. 97–106*).—This is a report of observations made over a period of six years, commencing in 1924. In the author's opinion the economic importance that has been credited to shrews has been greatly exaggerated. Shrews seldom occur in numbers sufficient to be of any real significance in cultivated areas. This animal usually prefers a habitat unsuited to crops, and while they may devour insects in large numbers, they certainly do not distinguish between noxious and beneficial forms. It is true that in a given locality they may be a potent factor in overcoming a small outbreak of a dangerous pest, but this is exceptional.

Puerto Rican ornithological records, S. T. DANFORTH (*Jour. Dept. Agr. Porto Rico, 15 (1931), No. 1, pp. 33–106, pls. 8*).—This contribution reports observations on the occurrence of 144 forms and is complementary to that published in 1926 (E. S. R., 57, p. 159).

Progress report of the Wisconsin prairie chicken investigation, A. O. GROSS (*Madison: Wis. Conserv. Comn., 1930, pp. 112, figs. 39*).—This report of the progress of an investigation now under way in Wisconsin considers the important factors controlling Wisconsin grouse, the laws relating to the prairie chicken in the State, the distribution and numbers, migration, parasites and diseases, food of the prairie chicken and sharp-tailed grouse, reported upon in 10 tables, winter feeding stations, weights and measurements of Wisconsin grouse, life history of the prairie chicken, eggs, hatching, unusual plumages of the prairie chicken and sharp-tailed grouse, hybrids of the two, blinds and photography, and detailed observations as recorded in field notes.

Salinity death-points of the oyster drill snail, Urosalpinx cinerea Say, H. FEDERIGHI (*Ecology, 12 (1931), No. 2, pp. 346–353*).—The author reports that oyster drills (*U. cinerea*) collected from areas in Hampton Roads, Va., where the summer salinity was 15 and 20 parts per million, had salinity death points of 12.5 and 11.7 parts per million, while snails collected at Beaufort, N. C., where the environmental salinity is over 30 parts per million, showed lethal salinities of 15.6 and 17.6 parts per million. This is interpreted to mean that the environmental salinity influences the death point salinity, although the relation is not directly proportional, since, as the animal becomes adapted to lower salinities, the salinity factor of safety (the difference between the average environmental salinity and the death point salinity) becomes smaller.

Trapping the oyster drill, J. R. NELSON (*New Jersey Stas. Bul. 523 (1931), pp. 12, figs. 5*).—This is an account of a study of the common oyster drill *Urosalpinx cinerea* Say and the less common oyster drill *Eupleura caudata*, which are the most destructive enemies with which the oyster industry of New Jersey is faced. It is said that on the oyster beds of Delaware Bay that come under the jurisdiction of New Jersey alone, these marine snails do an estimated damage of over $1,000,000 each year. A count of 10,000 individuals yielded 9,885, or more than 98 per cent, of *U. cinerea*, and 115 of *E. caudata*. The drill is mainly an enemy of young oysters, the average size of the adult *U. cinerea* in Delaware Bay being 28.8 mm., and occurs abundantly on the rocky coasts of New England, where its natural food is the barnacle. On the shifting bottoms of sand and of mud which form so much of the oyster planting area in the Delaware Bay there are no great rocky beaches covered with barnacles to lure the drills, so that they have left the shores here and, seeking deeper water, a more firm bottom, and food, have made their home among the oysters upon which they prey.

"There has been no effective control measure for the drill in Delaware Bay in the past other than lowered salinity through fresh water run-off. The use of the bag trap is a practical method of combating the drill; it is inexpensive and effective. The problem is a large one, and the control of the drill can be brought about only with the combined efforts and resources of a majority of the planters, and then only if salinity conditions remain as they have in the past, with sufficient fresh water coming down from upstream to keep the drill in check on the natural seed beds. The wire bag trap is not a trap in the true sense of the word, as drills can of course pass out of it as easily as they can crawl in, but practical results show that the drills do not leave, hence the trap can be periodically lifted and the drills shaken out."

Studies in arthropod hibernation.—III, Temperatures in forest hibernacula, A. M. Holmquist (*Ecology, 12 (1931), No. 2, pp. 387–400, figs. 5*).—This is a report of studies conducted in continuation of those previously noted (E. S. R., 59, p. 659).

The hatching of insects from the egg, and the appearance of air in the tracheal system, E. K. Sikes and V. B. Wigglesworth (*Quart. Jour. Micros. Sci. [London], n. ser., 74 (1931), No. 294, pp. 165–192, figs. 8*).—A report of studies of the hatching of the egg of the flea *Ceratophyllus wickhami*, the yellow meal worm, the Angoumois grain moth, the blowfly *Lucilia sericata*, the bedbug, and the sucking louse *Polyplax serrata*. A description is given of the mechanism of emergence from the egg and of the first appearance of gas in the tracheal system. A two-page list of references to the literature is included.

Notes on predicting the probable future distribution of introduced insects, W. C. Cook (*Ecology, 12 (1931), No. 2, pp. 245–247*).—This is a contribution from the Montana Experiment Station.

Animal parasites of wild and domestic mammals and their relationship to human welfare, E. C. Faust (*Sci. Mo., 32 (1931), No. 3, pp. 228–234*).—This is a popular account in which both ectoparasites and endoparasites are dealt with.

Insects, ticks, mites, and venomous animals of medical and veterinary importance.—Part II, Public health, W. S. Patton (*Croydon, Eng.: H. R. Grubb, 1931, pp. VIII+740, pls. [59], figs. 388*).—This, the second part of the work previously noted (E. S. R., 62, p. 542), presents the subject of entomology in its relation to public health in the form of lectures, with two appendixes.

The Soviet expedition for controlling pests injurious to agriculture in Mongolia (report 1929), K. A. Kazanskiĭ (Kazanskij) (*Sovetskaía Ékspeditsiía po Zashchite Rasteniĭ ot Vreditelei Sel. Khozíaĭstva v Mongolii. (Otchet za 1929 g.) Verkhneudinsk: Narod. Komis. Zeml. Buriat-Mongol. A. S. S. R. (People's Com. Agr. Buriat-Mongol Repub.), 1930, pp. 48+[3], pl. 1, figs. 10; Eng. abs., pp. [3]*).—This report on work of the 1929 expedition deals particularly with observations of the vole *Microtus brandti* Radde, which appears in eastern Mongolia in immense numbers, and of grasshoppers.

[Work in economic entomology at the New Mexico Station] (*New Mexico Sta. Rpt. 1930, pp. 55–62, 62–66, figs. 2*).—The progress of the work of the year with the codling moth (E. S. R., 63, p. 454) is considered under the headings of attrahent baits for trapping codling moth adults, experiments with poisoned bands and soil fumigants, and parasite investigations. The work with the trap baits included the testing of several types of bait pans for exposing the table molasses and malt sirup baits in an effort to discover a type that will give larger catches. In all of the tests with molasses baits Brer Rabbit sirup surpassed Diamalt in its attractiveness; and the addition to these sirups of yeast, either in compressed or dried form, lowered their attrahent value. Molasses baits which fermented slowly were more attractive than rapid fermenting ones, and consequently a series of preservative materials was tested in combination with the Brer Rabbit sirup, including formaldehyde, bichloride of mercury, alcohol, acetic acid, toluene, and sodium benzoate. The last mentioned material apparently retarded fermentation to the proper degree and materially increased the attractiveness of the bait.

Field comparisons were made of the attractiveness of 17 aromatic chemicals and esters by placing them in "Peterson evaporation cups" suspended in conical bait pails. Those found to be moderately attractive, listed in the order of attractiveness, were isobutyl phenyl acetate, geranyl formate, ethyl oxyhydrate, diphenyl oxide, citronellal, bromostyrol, and methyl cinnamate. Isobutyl

phenyl acetate caught a total of 68 moths in 49 days, or an average of 1.3 moths a day. Geranyl formate and ethyl oxyhydrate were almost as attractive, catching an average of 1.2 and 1.0 moths a day, respectively. As compared with molasses baits, one sample of Brer Rabbit molasses running at the same time but for a longer period of days, i. e., 51 days, caught 110 moths, or an average of 2.1 moths a day; and a second sample of molasses containing 0.5 per cent of sodium benzoate caught 133 moths, or a total of 2.8 moths a day.

The codling moth larva mortality in 1929 tree banding experiments with treated corrugated paper and burlap lined paper bands is shown in detail in tabular form. α-naphthalene and β-naphthol were the two most effective insecticides of the series, the former being more rapid in its action, killing 95 per cent of the larvae in the bands in 3 months. Red engine oil alone has a slight toxicity, approximately 10 to 15 per cent. Pine-oil Soluble was only slightly toxic in the strength used, although its degree of effectiveness could not be estimated as the burlap paper in which it was placed possesses a slight degree of toxicity also. The mortality of larvae in untreated corrugated paper bands was from 0.4 to 1.8 per cent. The susceptibility of the codling moth during the prepupal stage shown by spraying or painting contact insecticides upon corrugated bands containing overwintering larvae, indicated by dead larvae, was as follows: α-naphthalene (1 lb. in 1 pint of red engine oil) 85 per cent, Neoton (0.25 lb. plus potassium oleate soap 0.5 lb.) 80 per cent, Pine-oil Soluble (full strength) 58 per cent, Derrisol (full strength) 28 per cent, and pyrethrum soap emulsion (full strength) 30 per cent. Untreated corrugated paper bands of the same series showed a winter mortality of 10 per cent. The effectiveness of soil fumigants placed in mounds of earth around banded trees, as expressed in the percentage of dead larvae found in the bands after treatment, was as follows: Calcium cyanide (8 oz. per tree) 100 per cent, carbon disulfide (12 oz. per tree) 90 per cent, and paradichlorobenzene (6 oz. per tree) 80 per cent. The soil temperature during the 2-week period of the experiment varied between 49 to 54° F., and the effectiveness of these materials would undoubtedly have been greater under higher soil temperature conditions. The experiments suggested the possibility of control through (1) placing untreated bands on the trees in the fall, and then during the winter after the larvae have ceased seeking hibernating quarters painting them with a highly toxic contact insecticide such as α-naphthalene, or (2) mounding the trees and introducing one of the soil fumigants into the mounds.

In work with parasites of the codling moth, only one species, *Dibrachys boucheanus* Ratz., was reared during the year. The coleopterous predator *Cymatodera aethiops* Wolcott, continued to be the predatory enemy of the codling moth most evident in the State.

A brief reference is made to experiments with oil sprays in the control of the San Jose scale, as noted in the previous reports and in Bulletin 172 (E. S. R., 61, p. 355), in which red engine oil proved to be the most effective insecticide under New Mexico conditions. A 4 per cent emulsion, using Kayso as an emulsifier, was the most satisfactory combination to use in the hard waters of the New Mexico fruit-growing regions.

Notes are presented on the important insects affecting garden and field crops, including the Mexican bean beetle, cotton leaf worm, cotton bollworm, pepper weevil, a green June beetle *Cotinis texana* Casey, etc. Reference is made to a continuation of the life history studies of the giant apple root borer (E. S. R., 60, p. 64).

[Economic insects and insect control] (*Gold Coast Dept. Agr. Bul. 22 (1930), pp. 112–145, pls. 4; pp. 254–260, pls. 4; pp. 308–330, pls. 3; pp. 331–*

336).—The contributions here presented on control in the Gold Coast include the following: Report on the Occurrence of *Sahlbergella* spp. and Other Insect Pests of Cacao in Fernando Póo, San Thomé, and The Belgian Congo, and The Hispid Leaf-Miner (*Coelaenomenodera elaeidis* Maul.) of Oil-Palms (*Elaeis guineensis* Jacq.) on the Gold Coast, both by G. S. Cotterell, and The Recent Locust Invasion of the Northern Territories, Ashanti, Togoland, and Trans-Volta, with Notes on the Life-History and Control of the Locust, and Poisoned Baits as a Means of Combating Locust Invasions, both by W. Cook.

Report of the [Sudan] Government entomologist for the year 1929, H. H. King et al. (*Wellcome Trop. Research Labs., Ent. Sect. Bul. 31* (*1930*), *pp. 83, pls. 5*).—This report of the Government entomologist, assisted by nine assistant entomologists and a biologist, following an introduction deals with the work as follows: An Account of the Locust Season, 1929, by H. H. King and H. W. Bedford (pp. 7–14); A Note on the Control Measures Used against Locusts in Northern Kordofan, by W. Ruttledge (pp. 15–18); The Winter Breeding of Locusts in the Sudan (Season 1929–30), by R. C. Maxwell-Darling (pp. 19–21); Experiments with Arsenite of Soda and Sulphate of Copper for the Protection of Timber against Attack by Termites, by H. H. King (pp. 22–32); A Report on Work Carried Out at the Khartoum Laboratory during 1929 (pp. 33–38) and A Preliminary Note on Die-Back of Sunt (*Acacia arabica* Willd.) (pp. 39–41), both by H. W. Bedford; Summary Report on the Entomological Work of the Gezira Laboratory for the Year 1929, by H. B. Johnston (pp. 42–47); Pink Bollworm (*Platyedra gossypiella* Saund.) in the Gezira during 1929, by T. W. Kirkpatrick (pp. 48–54); Cotton Thrips (*Heliothrips indicus* Bagn.) in the Gezira in 1929, by W. P. L. Cameron (pp. 55–63); Observations on Leafhoppers (Homoptera Fam. Jassidae) in the Gezira in 1929, by A. P. G. Michelmore (pp. 64–66); A Note on Certain Minor Crop Pests Hitherto Unrecorded from the Gezira District of the Sudan, by H. B. Johnston (pp. 67–70); Report on the Entomological Work of the Berber Field Laboratory for the Year 1929, by J. W. Cowland (pp. 71–75); Report on the Entomological Work of the Talodi Field Laboratory for the Year 1929, by F. G. S. Whitfield (pp. 76–78); and Survey of the Pests Affecting Cotton and Other Crops in Mongalla Province, by W. Ruttledge (pp. 79–82).

Insects associated with the seeds of garden plants, G. F. Wilson (*Jour. Roy. Hort. Soc., 56* (*1931*), *No. 1, pp. 31–47, pls. 6, fig. 1*).—In this article the author considers (1) the insects feeding entirely in seeds, including pea and bean weevils (Bruchus), and (2) the insects feeding on seeds and (or) fruits, including the drug-store weevil, pea and scavenger moths (*Cydia nigricana* and *Borkhausenia pseudospretella*), and fruit flies (*Phagocarpus permundus* and *Spilographa alternata*).

Insect pests of sugar cane, I–V, T. E. Holloway (*Facts about Sugar, 25* (*1930*), *Nos. 23, pp. 566, 567, 573; 25, pp. 662–663; 27, pp. 744–746; 29, pp. 829–831; 26* (*1931*), *No. 2, pp. 69–71*).—These contributions deal, respectively, with (1) how insects affect the sugarcane plant; (2) entomology for the sugar planter; (3) insects—injurious, neutral, and beneficial; (4) the moth borers—their characteristics and distribution; and (5) the moth borers—their control.

Decomposition of rotenone in solution, H. A. Jones (*Indus. and Engin. Chem., 23* (*1931*), *No. 4, pp. 387, 388*).—It is shown that great care must be exercised in the making and keeping of solutions of rotenone. Benzene may prove particularly valuable as a solvent because of its high solvent power and the fact that with it no appreciable decomposition of rotenone occurs. When a water-soluble solvent is desired, acetone may be used. Solutions of rotenone should be freshly made, but if solutions are required to stand over a long period

of time they should be kept in air-tight containers. Rotenone should be stored and shipped in the dry condition whenever possible, since dry rotenone undergoes no decomposition.

Host selection and cannibalism in the bed bug Cimex lectularius L., E. Rivnay (*Ann. Ent. Soc. Amer., 23 (1930), No. 4, pp. 758–764*).—The subject is considered under the headings of feeding experiments with bugs upon warm-blooded animals, a feeding experiment on cold-blooded vertebrates, and cannibalism.

The bay psyllid, Trioza alacris Flor., H. W. Miles (*North West Nat., 3 (1928), No. 1, pp. 8–14, pls. 2*).—An account of this psyllid enemy of the bay tree, with a note on several other species of the genus that are of economic importance in various parts of the world.

North American leafhoppers of the Athysanella group (Homoptera Cicadellidae), H. Osborn (*Ann. Ent. Soc. Amer., 23 (1930), No. 4, pp. 687–720, figs. 52*).—This account includes a key to the genera, keys to the species, and descriptions of new genera and species. It is stated that the species here discussed are restricted to members of the grass family, and some of them have been very definitely connected with buffalo grass and the Bouteloua. The closer restriction to particular species of grasses, if it occurs for these species of leafhoppers, has not been determined with sufficient certainty to be recorded.

A monographic study of the North American species of Euscelis and allied genera (Homoptera-Cicadellidae), J. P. Sleesman (*Ent. Amer., n. ser., 10 (1929), No. 2, pp. 87–148, pls. 10*).—This contribution from the Ohio Experiment Station includes keys to the species of Euscelis and allied genera and descriptions of new genera and species.

The biology of the phytophagous capsid bug Dicyphus errans Wolff [trans. title], N. Schewket (*Ztschr. Wiss. Insektenbiol., 25 (1930), No. 10, pp. 179–183, figs. 7*).—Notes are presented on the biology of the capsid found associated with a leaf disease of *Pelargonium zonale* in the greenhouse, particularly in winter, the cause of which is as yet unknown.

The bionomics and control of Leptocorisa acuta Thunb., with notes on other Leptocorisa spp. in Malaya, G. H. Corbett (*Straits Settlements and Fed. Malay States Dept. Agr., Sci. Ser. No. 4 (1930), pp. [1]+40, pls. 7, figs. 5*).—Part 1 of this contribution on what is probably the principal pest of paddy in Malaya consists of a general account (pp. 1–8), part 2 a systematic account (pp. 9–17), part 3 a biological account (pp. 18–30), part 4 control measures (pp. 31–36), and part 5 an appendix and references to the literature (pp. 37–39).

Some notes on the paddy fly in Ceylon, J. C. Hutson (*Trop. Agr. [Ceylon], 75 (1930), No. 6, pp. 341–346*).—The author considers some of the reasons for the general prevalence of the paddy fly (*Leptocorisa varicornis*) throughout the year and for its importance as a pest and gives control measures.

Aphides as vectors of "breaking" in tulips, A. W. M. Hughes (*Ann. Appl. Biol., 18 (1931), No. 1, pp. 16–29, pl. 1*).—It has been found that the green peach aphid is a vector of the virus of "breaking" in tulips, and that *Macrosiphum gei* Koch is also a vector in a lesser degree. "Red break" and "white break" are transmitted equally by the two species. No conclusive evidence was obtained to show that *Anuraphis tulipae* B. de Fonse and *Rhopalosiphoninus tulipella* Theob. convey breaking and they appear to be unimportant vectors.

Further studies on aphid transmission of plant viruses, I. A. Hoggan (*Phytopathology, 21 (1931), No. 2, pp. 199–212, figs. 2*).—In an investigation made by the Wisconsin Experiment Station in cooperation with the U. S. D. A. Bureau of Plant Industry of several different species of aphids with a

view to determining their ability to transmit the virus of ordinary tobacco mosaic, two strains of the green peach aphid, derived from tobacco growing in the field, failed to transmit the tobacco mosaic virus between tobacco and other solanaceous host plants, although they readily transmitted the cucumber mosaic virus between the same hosts.

"Three other aphid species, namely, *Myzus pseudosolani*, *Macrosiphum solanifolii*, and *Myzus circumflexus*, were shown to transmit the cucumber mosaic virus readily from tobacco and from tomato. The above three species appear unable to transmit the tobacco mosaic virus from tobacco. They will, however, transmit this virus from tomato, *M. pseudosolani* causing very high percentages of infection. Evidence has been obtained to indicate that the peach aphid, on the other hand, does not transmit this virus from tomato, or on only very rare occasions. Transmission of the tobacco mosaic virus by *M. pseudosolani* was demonstrated from six different varieties of tomato, while from four other host species in addition to tobacco no transmission was obtained. From *Solanum nigrum* there was evidence of occasional transmission of the virus. *M. pseudosolani* was shown to transmit also a form of 'yellow tobacco mosaic' from tomato, but not from tobacco.

"The evidence thus far obtained indicates that aphids are unlikely to be responsible for any dissemination of ordinary tobacco mosaic, so far as transmission from tobacco is concerned. They may, however, play an important part in the dissemination of this disease on tomatoes, or from tomato to tobacco where these two crops are grown in close proximity. The failure of *M. pseudosolani* to transmit the tobacco mosaic virus from tobacco may be explained on the assumption that the aphid does not extract the virus from those tissues of the tobacco plant on which it feeds."

The spread of the cottony-cushion scale (Icerya purchasi Mask.) in France and its predator Novius cardinalis Muls. [trans. title], A. Balachowsky and L. Molinari (*Min. Agr.* [*France*], *Ann. Épiphyties, 16* (*1930*), *No. 1, pp. 1–24, figs. 6*).—Part 1 of this account deals with the biogeographical extension of the cottony cushion scale in France and in Algeria and its propagation in these countries (pp. 2–10), part 2 with its biology (pp. 10–16), and part 3 with the spread of its coccinellid predator *N. cardinalis* (pp. 16–22.)

Observations on the Coccidae of Formosa, II, R. Takahashi (*Formosa* [*Taiwan*] *Govt. Research Inst., Dept. Agr. Rpt. 48* (*1930*), *pp.* [*2*]+*45, figs. 22*).—This second contribution (E. S. R., 62, p. 452) reports upon studies of the Coccidae attacking bamboo in Taiwan, including 15 new species, and notes on certain species injurious to plants in Taiwan and Loochoo (Nansei), a food plant catalogue of the Coccidae of Taiwan (a supplement), and some Coccidae of Nansei.

The banana fruit-eating caterpillar (Tiracola plagiata Walk.), I, II (*Queensland Dept. Agr. and Stock, Div. Ent. and Plant Path. Bul. 5* (*1930*), *pp. 23, pls. 6*).—Part 1 of this account consists of Field Notes, by J. A. Weddell (pp. 1–12), and part 2 of Life History Notes, by M. E. Temperley (pp. 13–23). This noctuid moth, which has a wide distribution in tropical and subtropical regions, has been recorded as feeding in the larval stage on an extensive number of food plants, including many of economic importance. Rather full notes are given on the nature of its injury to cultivated host plants in Queensland, including the banana, corn, and pumpkin, which, during the outbreak in 1927, suffered most severely.

The growth and development of Ephestia kuehniella Zeller (Lepidoptera) and Tribolium confusum Duval (Coleoptera) under controlled conditions of temperature and relative humidity, T. A. Brindley (*Ann. Ent. Soc.*

Amer., 23 (1930), No. 4, pp. 741–757, figs. 4).—The life history of 100 individuals of the Mediterranean flour moth and of *T. confusum*, as determined under controlled conditions of 73 per cent relative humidity and a temperature of 30° C. (86° F.), is here reported upon.

Corn stalk borers [trans. title], J. FEYTAUD (*Rev. Zool. Agr. et Appl., 29 (1930), No. 6, pp. 85–96, pl. 1, figs. 3*).—Accounts are given of the two principal species of cornstalk borers occurring in France, namely, the European corn borer and *Sesamia nonagrioides* Lef.

A destructive fungous disease of the corn borer, C. L. LEFEBVRE (*Phytopathology, 21 (1931), No. 1, pp. 124, 125*).—This is an account of an epidemic of *Beauveria bassiana* on larvae of the European corn borer observed in the laboratory at Arlington, Mass. The mortality rose as high as 90 per cent in lots imported from Manchuria. In laboratory experiments 100 per cent larval mortality was obtained within 2 days when inoculated with conidia of *B. bassiana*, while in experiments with *B. globulifera*, which is common in the United States, only 4 larvae were killed in seven trials of 10 larvae each. Preliminary field tests in which spores of *B. bassiana* were dusted on corn borer infested fields indicated that at least a partial control of the borer can be obtained. The disease was first noted by the infected larvae turning pink, from which the name pink disease is derived. They soon become mummified, and after a few days a white mycelial outgrowth is evident which turns to a creamy, powdery mass due to abundant spore formation.

Preparation and use of chemically treated bands for codling moth control, G. E. MARSHALL (*Indiana Sta. Circ. 180 (1931), pp. 4, figs. 4*).—Three years of laboratory and field experiments with chemically treated bands are said to have proved that such self-working bands can be used in the place of ordinary bands in a commercial orchard at a very considerable saving of time and money to the fruit grower. This is especially true in orchards where the trees have been and are to be banded every year with untreated bands and the larvae collected beneath the bands and killed by hand.

The number of larvae captured by the self-working bands varies with the infestation of the orchard concerned. In a badly infested orchard in 1930 the average number of larvae captured per band was for alpha-naphthol-oil-parawax 105.5, for beta-naphthol-oil 79.4, and for untreated bands 81.5. In an orchard where the infestation was very light the number of larvae captured per band was for alpha-naphthol-oil-parawax 19.3, for beta-naphthol-oil 15.6; and for untreated 19.7. These two sets of figures are said to represent the extremes.

Directions are given for the preparation of both of the chemical bands above mentioned and their use. It is pointed out that the efficiency of any kind of tree band is directly dependent upon the removal of every bit of loose bark on the tree trunk and larger branches.

A brief summary of the large-scale bait-trapping experiments of 1930 against the oriental fruit moth at Vincennes, Ind., and Cornelia, Ga., W. P. YETTER, JR. (*Ill. State Hort. Soc. Trans., 64 (1930), pp. 567–571*).—A brief summary of preliminary work on large-scale bait trapping, definite conclusions regarding which can not as yet be drawn.

The boxwood leaf miner (Monarthropalpus buxi Labou), F. F. SMITH and H. J. FISHER (*Penn. Dept. Agr. Bul. 497 (1930), pp. 14, figs. [5]*).—A practical summary of information.

The diamond back moth (Plutella maculipennis) during the years 1914–1929, R. A. H. GRAY (*Jour. Roy. Hort. Soc., 56 (1931), No. 1, pp. 48–55,*

pls. 4).—This report of observations on the behavior of the diamond-back moth during the years 1914 to 1929, inclusive, embodies an attempt to correlate the fluctuations in population with the weather, food conditions, and parasites for the various years.

The occurrence of genetically distinct biological races of the house mosquito Culex pipiens [trans. title], E. ROUBAUD (*Compt. Rend. Acad. Sci.* [*Paris*], *191* (*1930*), *No. 25, pp. 1386–1388*).—The author calls attention to the fact that he has previously recorded the occurrence in France of two physiologically distinct forms of *C. pipiens*.[1] In the present contribution additional observations on the biological characteristics of the two forms are reported upon.

Observations on some aquatic animal and plant enemies of mosquitoes, C. R. TWINN (*Canad. Ent.*, *63* (*1931*), *No. 3, pp. 51–61*).—A contribution from the entomological branch, Canadian Department of Agriculture.

The transmission of epithelioma contagiosa by mosquitoes [trans. title], G. M. DE OLIVEIRA CASTRO (*Compt. Rend. Soc. Biol.* [*Paris*], *105* (*1930*), *No. 29, pp. 316–318*).—The author concludes from experiments conducted that *Culex quinquefasciatus* Say is capable of transmitting the epithelioma contagiosa form of fowl pox by its bite three days after infection (of the mosquito) as well as through the feces. The infective power of the feces is present even when defecation occurs five days after the mosquito has become infected and it has in the interval fed twice upon a normal fowl.

The structure and life-history of Sciara nitidicollis Meig. (Diptera), I. THOMAS (*Zool. Soc. London, Proc., 1930, IV, pp. 1009–1026, figs. 14*).—An account of the life history of a sciarid reared from decaying celery roots, together with descriptions of the various stages and the times taken in the different stages.

Discovery of the oesophageal stage larvae of Hypoderma lineatum Villiers in Indian cattle.—Preliminary observations, P. G. MALKANI (*Indian Vet. Jour.*, *7* (*1931*), *No. 3, p. 240*).—This note records the occurrence of larvae of the common cattle grub in the gullet walls, first parts of the stomach, and other situations. The possibility of their being the hitherto unknown immature larvae of *H. crossii* was excluded.

Rearing the larvae of Dermatobia hominis Linn. in man, L. H. DUNN (*Psyche*, *37* (*1930*), *No. 4, pp. 327–342, figs. 2*).—A detailed account of the day to day development of two larvae of *D. hominis* reared on man.

The wintering habits of muscoid flies in Iowa, R. A. ROBERTS (*Ann. Ent. Soc. Amer.*, *23* (*1930*), *No. 4, pp. 784–792*).—Following an introduction and tabulated lists of 18 species of flies trapped from October 2 to November 27, 1927, at Ames, Iowa, the subject is considered under the headings of species of flies trapped with an account of the species.

Probable distribution of the Mediterranean fruit fly (Ceratitis capitata Weid.) in the United States, C. M. GJULLIN (*Ecology*, *12* (*1931*), *No. 2, pp. 248–258, figs. 13*).—This contribution from the Montana Experiment Station is presented under the headings of life history, climatic conditions affecting life history, summary of climatological effects, climate of countries in which *C. capitata* is known to occur, summary of the effect of climatic conditions in all infested areas, and the fruit fly in the United States.

From the study of the more important available data on the effect of temperature, rainfall, and humidity on the life history of the Mediterranean fruit fly and a climatological study of all known occurrences of the fruit fly in the

[1] Compt. Rend. Acad. Sci. [Paris], 188 (1929), No. 10, pp. 735–738.

different parts of the world to determine optimum and limiting conditions, it is concluded that if the pest is permitted to become established severe infestations may be expected in southern Florida and southern Texas.

"In the greater portion of the fruit-growing sections where this insect can maintain itself, it would cause a medium infestation. Within this zone it would be held down to small numbers by climatic conditions, and only occasionally would large populations of the fly be produced. Portions of Oregon, California, Nevada, Arizona, New Mexico, Texas, Oklahoma, Arkansas, Mississippi, Alabama, Georgia, Florida, South Carolina, and North Carolina, and all of Louisiana would be included in this zone. Beyond this zone of occasional abundance is a narrower zone of possible abundance. Within this zone the insect can not maintain a permanent population, but under favorable conditions it may cause outbreaks. Portions of Washington, Oregon, California, Nevada, Arizona, New Mexico, Texas, Colorado, Oklahoma, Arkansas, Tennessee, Kentucky, North Carolina, and Virginia would be included in this zone."

The biology, post-embryonic development, and economic importance of Cryptochaetum iceryae (Diptera, Agromyzidae) parasitic on Icerya purchasi (Coccidae, Monophlebini), W. H. Thorpe (*Zool. Soc. London, Proc., 1930, IV, pp. 929–971, pls. 5, figs. 23*).—This is a contribution from the Graduate School of Tropical Agriculture, University of California, and the California Experiment Station, in which the life history of an agromyzid dipteran parasitic on the cottony cushion scale is described.

The species is said to represent a separate and restricted line of evolution of parasitic habits among insects. The egg is laid in the hemocoel of the host, usually during the second instar. The primary larva is a minute embryo larva of a type hitherto undescribed in Diptera, but known among parasitic Hymenoptera. "It lacks tracheal system, heart, mouth, mouth parts, and sense organs, and is without segmentation. It absorbs its food by osmosis direct from the blood of its host. The second and third larval stages are tracheate but apneustic. They are remarkable for the lengthy tubular tails at the posterior end of the body, containing blood and tracheae, and which increase in length with each instar. Mouth and mouth parts, sense organs, and heart are now normal, and segmentation is complete. The mid-gut is still closed posteriorly in correlation with the plasmophagous mode of life. The muscular system is poorly developed, no circular muscles being present. There is a dense subcuticular network of tracheae. The fourth stage is omnivorous. The hind-gut is open and the mouth parts much modified. Anterior and posterior spiracles are now present, but the anterior ones only are open, and these are apparently nonfunctional till the time of pupation. As many as 17 larvae may come to maturity in a single host. The presence of late stage larvae appears to have an inhibiting effect on the development of the earlier stages."

The puparium is formed in the dead cavity of the host. The internal anatomy of the larva is described, being chiefly remarkable for the closure of the mid-gut posteriorly until the final instar. "The adult is short lived and intolerant of captivity. Mating is described. About 200 eggs are laid. The female can apparently distinguish a scale containing advanced parasite larvae from one unparasitized. A high proportion of eggs are infertile, in one case amounting to 20 per cent. The adult is described, and diagnostic characters for distinguishing it from closely allied species are given. The structure of the antenna was investigated, and [A. H.] Sturtevant's statement that the apparent third segment is in reality the missing arista was shown to be incorrect. Knowledge as to the remaining members of the genus is briefly summarized, and

a key to all the known species is given. The history of the original introduction into California was investigated. It appears probable that two species, [*C.*] *iceryae* and [*C.*] *monophlebi* were introduced, but that only the former became established. The economic importance of this insect was for a long while underestimated. It is potentially almost as efficient in the control of the cottony cushion scale as Vedalia. The factors which go to make up this efficiency are discussed."

A list is given of 52 references to the literature.

Disinfection of American foulbrood combs by fumigation with formaldehyde, II, C. E. Burnside (*Bee World, 12 (1931), No. 2, pp. 16–19*).—This continuation of the account previously noted (E. S. R., 64, p. 550) deals with the rate of sterilization in combs at different distances above the formalin, fumigation in a metal tank, unsatisfactory results obtained by honey producers, and absorption of formaldehyde by honey and pollen. The cultural results of tests with combs fumigated for six days in a fumigating tank of 120-comb capacity and cultural results obtained with samples of combs fumigated by honey producers with formaldehyde gas and submitted for sterility tests are presented in tabular form. The rate of sterilization was determined by cultural studies of the infected brood remains.

Sterilization was found to proceed more rapidly at normal room temperature or at 37° C. than at temperatures near 0°. It proceeded more rapidly with formalin than with formalin-water solution.

A list of 20 references to the literature cited is included.

A contribution to the knowledge of the bionomics of Bremus americanorum (Fabr.) (Hymenoptera), T. H. Frison (*Ann. Ent. Soc. Amer., 23 (1930), No. 4, pp. 644–665, figs. 6*).—Following an introduction, the systematic position of the bumblebee *B. americanorum* is considered, followed by a report of specific life history studies (pp. 645–652), including several experiments, a biological summary (pp. 653–664) including a résumé of the literature, etc. A list of 33 references to the literature is included.

***Apanteles thompsoni* Lyle, a braconid parasite of the European corn borer,** A. M. Vance (*U. S. Dept. Agr., Tech. Bul. 233 (1931), pp. 28, figs. 7*).—The author reports upon studies of a gregarious braconid parasite, *A. thompsoni*, a form first mentioned in literature in 1927, in which year it was described as new by G. T. Lyle[9] from specimens collected in northern France. It was first detected in the larvae of the European corn borer in mugwort (Artemisia) near Brussels, Belgium, in 1920 by Thompson and Parker (E. S. R., 59, p. 354).

The biology, seasonal history, limiting factors, extent of its parasitism, etc., are taken up. Its importance as a parasite of the European corn borer in its natural habitat has varied from year to year, and its prevalence within restricted areas has differed considerably. The maximum parasitism recorded for the species, 42.6 per cent, was found in a lot of borer larvae from Lille, France, in 1924, with an average of 22.9 per cent for all collections made that year. The species is thelyotokous, males being entirely unknown, this being the second example of thelyotoky among braconid parasites, a form of parthenogenesis commonly met with in the Chalcididae. The female with a single thrust of her ovipositor usually deposits from 20 to 25 eggs within the body cavity of the young European corn borer larvae. The eggs hatch in about 5 days into larvae which pass two full stages and the greater part of a third stage within the host, and when nearly full grown issue from the host and spin their cocoons. The adults emerge about 14 days later. The species overwinters as a partly grown first-stage larva within the body of the host. The

[9] Bul. Ent. Research, 17 (1927), No. 4, p. 415.

available data indicate the occurrence of but one generation annually in the Lille region.

A list is given of 30 references to the literature.

A contribution to the study of the biochemic specificity of parasites: The oil of Exeristes roborator Fab. [trans title], J. Timon-David (*Compt. Rend. Soc. Biol. [Paris], 106 (1931), No. 10, pp. 829–831*).—From a comparative study of the composition of the reserve fats in the bodies of this parasite and its host—the European corn borer—it is concluded that there is no difference in the fats, and that this parasite assimilates the lipoids directly from the host with no appreciable change.

Preliminary report on the physical ecology of certain Phyllophaga (Scarabaeidae, Coleoptera), H. L. Sweetman (*Ecology, 12 (1931), No. 2, pp. 401–422, figs. 7*).—This is a preliminary report of work conducted at the Minnesota Experiment Station in 1926 on the direct effects of six physical factors, namely, temperature, moisture, light, barometric pressure, air movement, and nutrition. as they affect the common May beetles in Minnesota.

The climatic limitations of the Mexican bean beetle, S. Marcovitch and W. W. Stanley (*Ann. Ent. Soc. Amer., 23 (1930), No. 4, pp. 666–686, figs. 4*).—Following an introduction and references to the literature, the authors consider the measure of droughtiness, the climate of Tennessee, the humid East favorable for the beetle, the limiting factors of the southern Plains States, drought conditions in the Gulf States, the western infestation of the beetle, Mexico the original home of the bean beetle, temperature and moisture studies under controlled conditions, and future spread of the bean beetle based on climate.

Morphology and biology of Coccinella septempunctata, a beneficial ladybird beetle [trans. title], T. Pagliano (*Dir. Gén. Agr., Com. et Colon. [Tunis], Bul., 34 (1930), No. 143, pp. 369–403, figs. 7*).—A report of studies of an important enemy of coccid and aphid pests.

Tropisms and sense organs of Coleoptera, N. E. McIndoo (*Smithsn. Misc. Collect., 82 (1931), No. 18, pp. 70, pls. 2, figs. 19*).—Following an introduction, the author deals with tropisms (pp. 3–43), sensory receptors (pp. 43–58), and scent-producing organs and reflex "bleeding" (pp. 58–61). A list of 97 references to the literature is included.

ANIMAL PRODUCTION

The American Society of Animal Production: Record of proceedings of the twenty-third annual meeting, November 28–29, 1930 (*Amer. Soc. Anim. Prod. Proc. 1930, pp. 329, pl. 1, figs. 13*).—This is the report of the annual meeting held at Chicago, November 28 and 29, 1930 (E. S. R., 63, p. 360). The following papers were presented:

Present-Day Demands, by H. J. Gramlich (pp. 13–17); Some Problems of the Range Livestock Producer, by V. V. Parr (pp. 17–21); Beef Production Problems in the Corn-Belt, by J. W. Burch (pp. 21–23); Problems of Eastern Beef Production, by C. V. Wilson (pp. 24–26); Progress in Range Utilization Research in the Northern Great Plains Region, by J. T. Sarvis (pp. 26–30); Parasites in Relation to Animal Husbandry Research and Livestock Production, by M. C. Hall (pp. 30–34); What the Federal Farm Board is Doing for Livestock Producers, by C. B. Denman (p. 34); Group Feeding as a Method of Livestock Experimentation, by W. E. Carroll (pp. 34–44); Interpreting the Results of Group Feeding Experiments, by J. L. Lush (pp. 44–55); Individual Feeding for the Comparative Feeding Trial, by E. W. Crampton (pp. 56–68); The Paired-Feeding Method: Its Value and Limitations in Livestock Experi-

mentation, by H. H. Mitchell (pp. 63–73); Experimental Feeding Methods with Dairy Cattle and the Interpretation of the Results They Yield, by L. A. Maynard (pp. 74–81); Relation of Feed to Bone Strength in Cattle, by R. B. Becker and W. M. Neal (pp. 81–88); The Use of Marine Products in Animal Nutrition, by J. R. Manning (pp. 88–92); Problems in Range Nutrition in California, by H. R. Guilbert (pp. 92–97); Research in Animal Physiology and Genetics in Great Britain, by S. A. Asdell (pp. 97–101); The Work of the Department of Animal Genetics of the University of Edinburgh, by F. B. Hutt (pp. 102–105); Research in Animal Breeding in Germany and Austria, by W. Landauer (pp. 106–110); Animal Breeding Projects in Russia, by D. C. Warren (pp. 110–113); Inbreeding Work Under Way with Beef Cattle, by L. M. Winters (pp. 114–117); Inbreeding of Horses, by W. S. Anderson (pp. 117–119); The Inbreeding Problem in Poultry, by W. V. Lambert (pp. 120–126); Present Status of Inbreeding with Sheep, by B. L. Warwick (pp. 126–128); Swine Inbreeding at the United States Department of Agriculture Laboratories and at the State Experiment Stations (pp. 128–131) and Swine Inbreeding at the United States Department of Agriculture: A Progress Report (pp. 131–134), both by H. C. McPhee; The Experimental Development of the Mammary Gland, by C. W. Turner and A. H. Frank (pp. 134–136); Stability of the Lactation Curve in Guernsey Cattle, by W. L. Gaines (pp. 136–138); Some Observations of the Estrual Cycle in the Sheep, by F. F. McKenzie and R. W. Phillips (pp. 138–143); Intensive Grassland Management, by R. C. Foley (pp. 144–152); The Construction and Use of Trench Silos in Humid Regions, by S. W. Greene (pp. 152–156); How Important Are Rapidity of Gain and Market Topping Prices in Determining Profit in Cattle Feeding? by P. Gerlaugh (pp. 156, 157); Wheat for Fattening Yearling Steers, by H. C. Moffett (p. 158); Winter Versus Summer Feeding of Corn to Two-Year-Old Steers, Finished on Grass, by E. S. Good and W. J. Harris (pp. 159, 160); Grain on Grass Compared with Grass Alone for Fattening Steers, by C. I. Bray (pp. 161–163); Methods of Fattening Steers on Grass, by W. H. Black (p. 163); Rations for Fattening Steers, by W. L. Blizzard (p. 163); Sweet Clover as a Hay Crop, by W. H. Peters (pp. 163, 164); Blood Lines That Have Produced Winning Carcasses, by R. S. Stephenson (pp. 164–167); Dried Skimmilk in Rations of Dairy Calves, by I. W. Rupel and G. Bohstedt (pp. 167–169); Experimental Work Needed with Horses, by A. B. Caine (pp. 169–172); Big Hitches on Illinois Farms, by E. T. Robbins (pp. 173–175); Champion Pulling Teams, by H. F. Moxley (pp. 176, 177); The Effect of the Stallion Law on the Horse Breeding Industry in Minnesota, by A. L. Harvey (pp. 177–180); Metabolism Harness for Horses, by C. E. Howell (pp. 180–183); Upgrading Native Eastern North Carolina Ewes, by J. E. Foster (pp. 183–185); Urinary Calculi in Sheep: A Progress Report, by B. E. Pontius, R. H. Carr, and L. P. Doyle (pp. 185–190); Factors Involved in the Fattening of Show Wethers, by L. J. Horlacher (pp. 190, 191); Relation of Weight of Pelts of Lambs to the Weight and Grade of Their Carcasses, by D. A. Spencer (pp. 192–195); Factors That Affect the Quality of Wool, by A. E. Darlow (pp. 195, 196); Wool Shrinkage Determination by Means of Small Samples, by R. H. Burns (pp. 196–203); The Relation of the Plane of Nutrition to the Breaking Stress, Limit of Elongation, Rate of Growth, and Diameter of the Wool Fiber, by J. F. Wilson (pp. 203–206); Wool Marketing in the Range Country, by J. A. Hill (pp. 206–211); Show-Ring Studies with Rambouillet Wool, by F. S. Hultz (p. 212); Factors Related to the Growth of Suckling Pigs, by A. G. Hogan (pp. 212–215); Some Deficiencies of Barley for Young Growing Pigs, by E. H. Hughes, M. A. Lindsay, and H. C. Smith (pp. 216–218); Scabbed Barley and Oats and Their Effect on Various Classes of

Livestock, by B. H. Roche and G. Bohstedt (pp. 219–222); The Effect of Mineral Additions to Practical Swine Rations, by G. Bohstedt (pp. 222–225); The Effect of Place of Feeding Ear Corn to Hogs on Their Consumption of Supplemental Minerals, by E. J. Wilford (pp. 225–227); Cottonseed Meal for Pigs, by W. L. Robison (pp. 227–232); Preparation of Darso for Fattening Hogs, by C. P. Thompson (pp. 232–234); Commercial Mixed Protein Feeds as Supplement to Farm Grains for Swine, by G. A. Brown (pp. 234–237); The Relation of Nutrition to Necrotic Enteritis in Young Growing Pigs, by E. H. Hughes (pp. 237–242); Comparative Yields of Government Grades of Slaughter Barrows and Gilts, by F. H. Helmreich and R. O. Roth (pp. 242–244); The Effect of Smith-Hughes Teaching and 4-H Club Work on Animal Husbandry Curricula, by E. F. Ferrin (pp. 245–249); Objectives of College Instruction in Animal Husbandry, by E. A. Trowbridge (pp. 249–254); Improvement of Instruction in Animal Husbandry, by D. W. Williams (pp. 254–260); Harmonizing Teaching with Research Work, by F. G. King (pp. 260–268); Some Observations on Meat Research to Date, by E. W. Sheets (pp. 298–300); and Meat Merchandising in 1931, by E. L. Rhoades (pp. 301–305).

Commercial feeding stuffs—report on inspection, 1930, E. M. Bailey et al. (*Connecticut State Sta. Bul. 325 (1931), pp. 241–349+XX*).—This is the usual report of the guaranties and analyses of feeds officially inspected during the calendar year 1930 (E. S. R., 63, p. 657).

Utilizing the soybean crop in livestock feeding, H. P. Rusk, W. B. Nevens, W. G. Kammlade, J. L. Edmonds, C. W. Crawford, W. E. Carroll, and H. J. Sloan (*Illinois Sta. Circ. 369 (1931), pp. 44, figs. 7*).—The use and value of soybeans, soybean oil meal, and soybean hay for dairy and beef cattle, sheep, horses, swine, and poultry, together with their possibilities and limitations, are described in this publication.

The digestibility of cottonseed meal as a supplementary feed for range cattle in New Mexico (*New Mexico Sta. Rpt. 1930, pp. 49–51*).—Continuing this study (E. S. R., 62, p. 760), seven digestion trials of 28 days each were run. Wheat straw was fed as a basal ration in all trials and was supplemented in trials 3 to 7, inclusive, with 0.25, 0.5, 0.75, 1, and 1.5 lbs. of cottonseed meal, respectively. The average daily gains in the respective trials were 1.62, 0.13, 0.12, 0.41, 0.85, 0.73, and 0.86 lb. per head. The average nitrogen balances were −18.5, −20.5, −49.4, 12.7, 34.6, 67.4, and 61.4 gm. in the respective lots.

Lamb feeding investigation, R. F. Johnson, E. F. Rinehart, and C. W. Hickman (*Idaho Sta. Bul. 176 (1931), pp. 10*).—Concluding this 3-year study (E. S. R., 63, p. 558) at the Caldwell substation, it was shown that the greatest effect of chopping and grinding alfalfa hay was the reduction in the amount of hay wasted or refused. This wastage amounted to 30.1 per cent for long hay, 13.8 per cent for chopped hay, and 1.8 per cent for ground hay. Preparing the hay decreased the cost of gains slightly, but had no effect on the rate of gains.

Grinding grain for lambs did not increase their rate of gain, but did increase the cost of gains. Wheat was found to be less valuable, both from the standpoint of rate and economy of gains, than either corn or barley, and difficulty was encountered in keeping lambs on full feed when receiving wheat. Silage failed to improve the ration or to replace enough hay to justify its general use. Adding cottonseed meal to a ration of barley or corn and alfalfa hay increased the rate of gains and the degree of finish markedly. Cull beans, because of their unpalatability and the digestive disorders they caused, did not appear to be well suited for fattening lambs.

In these tests younger and smaller lambs when fed by themselves made as large and economical gains as average sized feeder lambs.

[Poultry studies at the New Mexico Station] (*New Mexico Sta. Rpt. 1930, pp. 103–107*).—The results of two studies are noted.

Poultry management and cost of production.—Using the same methods and feeds as in the previous test (E. S. R., 63, p. 470), it was found that the average egg production from December 1 to November 1 was 136, 130, 138, and 154 eggs per bird. There was a variation of only 5 lbs. in the total feed consumption between the low- and the high-producing lots.

Poultry nutrition.—In this study 6 lots of 60-day-old White Leghorn chicks each were fed the same basal ration. Lots 1 and 6 received the basal ration only; lot 2, 10 per cent of cottonseed meal replacing 10 per cent of corn gluten meal; lot 3, 10 per cent of cottonseed meal replacing 10 per cent of meat and bone meal; lot 4, 10 per cent of alfalfa leaf meal replacing 10 per cent of corn gluten meal; and lot 5, 10 per cent of alfalfa leaf meal replacing 10 per cent of meat and bone meal. Lot 6 received the basal ration fed ad libitum, while the other lots received daily a weighed amount of feed which was less than the amount they would normally have consumed. A duplicate test was started 8 days after the initial test.

At the end of 8 weeks the chicks in the first test averaged 407, 387, 329, 346, 311, and 389 gm. per head in the respective lots, while those in the second test averaged 403, 404, 324, 353, 313, and 404 gm. per head, respectively. The total feed consumed was 1,150 lbs. per lot for the first 5 lots in each test and 1,070 and 1,258 lbs. in lots 6 in the respective tests. A leg weakness, which appeared to be of a nonrachitic type, developed in all lots, but was most evident in the lots which did not receive alfalfa leaf meal.

The application of nomographic methods to the field of poultry husbandry, L. E. Card (*Poultry Sci., 9 (1929), No. 1, pp. 27–38, figs. 9*).—In this paper from the Illinois Experiment Station the author describes the use of nomographic or alignment charts in connection with various problems that arise in the field of poultry husbandry.

A biometrical study of the mortality of Single Comb White Leghorn chicks, E. C. Voorhies and G. A. Read (*Hilgardia [California Sta.], 5 (1931), No. 17, pp. 531–590, figs. 14*).—The livability of 6,398,366 Single Comb White Leghorn chicks was the basis on which this study was begun. The data were obtained from the records of commercial hatcheries at Petaluma, Calif. The eggs were from breeding flocks ranging in size from 500 to 5,000 hens and were all obtained within a radius of 25 miles. The records covered a period of 3 years.

It was found that the fifth day marked the peak of mortality of chicks during the first 14 days of the brooding period, and losses normally declined after the fifth day. There were indications that a typical curve depicts the chances of life for a chick during the first 14 days, and a chick has 920 chances out of 1,000 of reaching the fifteenth day of the brooding period. The modal loss during the initial 2 weeks of brooding was considered to be approximately 5 per cent.

Little difference was found in the quality of chicks sent out from commercial hatcheries from month to month and from season to season. There were no marked indications that early feeding of these chicks was an advantage. During the 3 years of the study there were no significant differences or changes in distribution, variability, or extent of mortality of the chicks. Because of the lack of sufficient data, no conclusions were drawn as to the effect on mortality of the number of chicks cared for at one time.

Statistical studies of the variations in the growth of Single Comb White Leghorns and their significance, E. M. Funk, H. C. Knandel, and E. W.

CALLENBACH (*Poultry Sci.*, *9* (*1930*), *No. 3*, *pp. 157–163*).—Concluding this study at the Pennsylvania Experiment Station (E. S. R., 64, p. 168), it was found that chicks were highly variable individuals and that the variation in the growth of Single Comb White Leghorn chicks was not constant. No correlation was found between initial chick weight and subsequent weights, but weights at 4, 8, 16, and 24 weeks showed a high positive correlation.

The nutritive requirements of poultry.—VII, Growth in chickens, II, M. MOIR, H. NEWBIGIN, A. KINROSS, and G. S. ROBERTSON (*Scot. Jour. Agr.*, *12* (*1929*), *No. 3*, *pp. 291–296*).—Continuing this series of studies with chicks (E. S. R., 57, p. 72), it was found that separated milk was as valuable as whole milk for growth. Semisolid buttermilk, dried milk, and a synthetic milk were also valuable supplements, but produced smaller gains than either whole or separated milk.

Adding feeds rich in animal protein and minerals, such as fish meal or meat and bone meal, increased the rate of growth but not at the same rate as whole or separated milk. Certain vegetable proteins supplemented with mineral mixtures gave as good results as fish meal, and the same was true of the addition of minerals alone.

Protein requirements of growing pullets, R. E. ROBERTS (*Poultry Sci.*, *9* (*1929*), *No. 1*, *pp. 19–26*).—In studies with chicks at the Indiana Experiment Station, it was found that a ration made up of yellow corn, wheat bran and middlings, bone meal, salt, and cod-liver oil, and containing 4.5 per cent of meat scrap protein was fairly satisfactory for growing pullets from 10 weeks of age to maturity. There were indications, however, that 7.5 per cent of meat scrap protein would produce more uniform growth during this period. Maximum growth from 10 to 23 weeks of age could not be obtained when 1.5 per cent of meat scrap protein was fed. There appeared to be some advantage in feeding a ration high in protein during the first 10 weeks in an effort to give chicks a good start.

The relative utilization of certain calcium compounds by the growing chick, G. D. BUCKNER, J. H. MARTIN, and W. M. INSKO, JR. (*Poultry Sci.*, *9* (*1929*), *No. 1*, *pp. 1–5*).—Continuing the study of the mineral requirements of chicks (E. S. R., 62, p. 255) at the Kentucky Experiment Station, 6 lots of 20 chicks each were fed a basal ration of yellow corn, wheat middlings, skim milk, salt, and cod-liver oil 80:20:20:1:2. In addition the respective lots received the following mineral supplements in such quantities as to make the calcium content equal to that of 5 parts of limestone and 5 parts of bone meal: None, limestone, limestone and raw bone meal, raw bone meal, rock phosphate, and commercial dicalcium phosphate. At the end of 12 weeks a representative cockerel in each lot was killed and ash determinations made of the femurs, tibias, and fibulas.

The chicks in lot 5 did not grow normally, and by the end of the third week 4 had died. The supplement for this lot was changed to bone meal and limestone, and during the next 4 weeks the surviving chicks recovered entirely. Rock phosphate was then again fed, and the chicks thrived and grew well to the end of the test. Lots 3 and 4 grew at about the same rate and were in the best physical condition of any of the groups. The chicks in lot 1 grew as well as those in lot 2 and about the same as those in lot 6. There were only slight differences in the percentage of calcium in the ash of the leg bones from the different lots.

The availability of calcium in calcium salts and minerals for bone formation in the growing chick, R. M. BETHKE, D. C. KENNARD, and C. H. KICK (*Poultry Sci.*, *9* (*1929*), *No. 1*, *pp. 45–50*).—Continuing the study of mineral

requirements of chicks at the Ohio Experiment Station (E. S. R., 63, p. 68), a ration low in calcium was selected which in previous trials produced good growth and normal calcification when properly supplemented. To the basal ration was introduced at the expense of yellow corn, 0, 0.5, 1, 1.5, 2, and 3 per cent of calcium carbonate. Bone analyses were made on 10 representative birds from each lot at 4 weeks old and on the remaining birds at 8 weeks of age. The analyses showed that the basal ration required a supplement of 2 per cent of calcium carbonate to secure optimum calcification.

After establishing the minimum calcium requirements the availability of calcium in various salts and minerals for bone formation was determined, using the same basal ration. The various supplements were introduced at the expense of corn in such amounts that the calcium intake was equal to that of the 2 per cent calcium carbonate ration. These results showed no difference in the availability of calcium in the carbonate, sulfate, lactate, and phosphate salts, or in limestone, steamed bone meal, rock phosphate, phosphatic limestone, or oyster shell for bone formation in the growing chick when fed at the same calcium intake but on a minimum requirement basis.

Does cod liver oil of high acid content have toxic properties? A. D. Holmes, W. B. Moore, J. S. Bennett, and M. G. Pigott (*Poultry Sci., 9 (1930), No. 3, pp. 164–174, figs. 2*).—In this test, 4 pens of 100 chicks each were fed the same basal ration from hatching time to 14 weeks of age. At the end of the second week 1.5 per cent of oil was added to the ration. The oils used were cottonseed oil containing 0.05 per cent acid, serving as a control, and cod-liver oil with acid values of 0.98, 5.92, and 11.65 per cent, respectively.

The average rate of growth was practically the same in all pens, as was also the average weight per bird at the end of the test. The total mortality was 10 in pen 1, 14 in pen 2, 40 in pen 3, and 28 in pen 4. Histological examinations and bone ash determinations at the end of the third, fifth, and eighth week showed normal bone structure and indicated that all birds received sufficient vitamin D and minerals. However, a comparison of the physical condition and development at the end of the test showed that while pens 1 and 2 were well pigmented, uniform in size, alert, and active, pens 3 and 4 were almost entirely lacking in yellow pigmentation, were not uniform in size, and were listless.

These results indicate rather definitely that cod-liver oils of high acid content may contain factors detrimental to young chicks.

Winter sunlight, ultra violet light, and glass substitutes in the prevention of rickets in growing chicks, H. T. Scott, E. B. Hart, and J. G. Halpin (*Poultry Sci., 9 (1929), No. 1, pp. 65–76*).—Continuing this study at the Wisconsin Experiment Station (E. S. R., 61, p. 165), it was found that the glasses for transmitting rays of short wave lengths were beneficial for preventing rickets in growing chicks. Their beneficial effect depended upon the time of exposure, the thickness and transmissibility of the glass, and the intensity of the active rays. With a quartz mercury lamp and with glass filters, 8 and 10 minutes' daily exposure were sufficient for normal calcification in all cases except window glass. Exposures of 8 minutes per week were insufficient except when the chicks were exposed to the direct rays of a quartz mercury lamp.

When chicks were exposed for the entire daylight period, normal calcification was brought about by the antirachitic effect of the sun's rays through the glass filters during the four seasons of the year with the exception of ordinary window glass, where only a slight antirachitic effect was induced, and of Cel-O-Glass during March and April and Flex-O-Glass during December and January, which showed a lowered antirachitic effect. A sharp increase was noted in the anti-

rachitic effect of sunshine during January and February. Solarization decreased somewhat the transmissibility in all of the substitutes.

Does rearing chicks in confinement affect the red cell or hemoglobin content of their blood? L. P. DOYLE, F. P. MATHEWS, and R. E. ROBERTS (*Poultry Sci., 9 (1929), No. 1, pp. 6–12*).—This report from the Indiana Experiment Station is a more detailed account of work previously noted (E. S. R., 63, p. 562).

The dry matter in different layers of egg albumin, A. L. ROMANOFF (*Science, 70 (1929), No. 1818, p. 314, fig. 1*).—In a study at the New York Cornell Experiment Station, it was found that the three different layers of albumin of a fresh hen's egg (outer, middle, and inner) contained 39.8, 57.2, and 3 per cent, respectively, of dry matter.

DAIRY FARMING—DAIRYING

Proceedings of the twenty-fifth annual meeting of the American Dairy Science Association (*Jour. Dairy Sci., 13 (1930), No. 6, pp. 528–537*).—A brief résumé of the meeting held at Iowa State College, June 24–26, 1930, together with the titles of the papers presented in the various sections (E. S. R., 62, p. 874).

Proceedings of the twenty-third annual convention of the International Association of Milk Dealers: Laboratory section (*Internatl. Assoc. Milk Dealers, Proc., 23 (1930), Lab. Sect., pp. 167, figs. 22*).—At this meeting (E. S. R., 63, p. 869) held at Cleveland, Ohio, October 20–22, 1930, the following papers were presented: Recent Research and Discoveries in Dairy Chemistry with Special Reference to the Caseins of Milk, by D. C. Carpenter (pp. 5, 6); Symposium—Detection of Abnormal Milk (a) Detection of Garget and Mastitis, by L. S. Dibble (pp. 7–9); (b) The Thybromol Test for the Detection of Mastitis, by A. M. Mills (pp. 10–13); (c) Ropy Milk on the Farm and in the Plant, by F. M. Scales and W. C. Horton (pp. 13–20); and (d) Abnormal Flavors in Milk, by C. J. Babcock (pp. 20–25); Symposium—Soaker Type Washers (a) Recent Developments and Data in the Soaker Type Washer, by L. A. Baumann (pp. 25–37); (b) Washing and Sterilizing Solutions–1, Efficiency of Various Washing Compounds, by A. H. Johnson (pp. 38–48); and (c) Temperature Control Efficiency, by M. E. Parker (pp. 48–51); Report of the Laboratory Methods Committee, by R. C. Fisher et al. (pp. 51–57); Udder Infections Due to Streptococci, by R. S. Breed (pp. 57–75); Symposium—Application and Procedure of Chemical Sterilization (a) "What Chemicals Are Best Adapted for Sterilization of Dairy Equipment"–1, Milk Bottles, by R. P. Myers (pp. 75–85); 2, Metal Surfaces (Coolers, Cans, and Vats), by O. F. Hunziker (pp. 86–96); and 3, Glass Lined Tanks, by F. M. Scales and H. E. Russell (pp. 96–103); (b) Practical Tests for Determining the Strength of Chlorine Solutions, by A. H. Johnson (pp. 103–106); Symposium—Laboratory Technique (a) Faulty Technic as Practiced by Laboratory Workers, by F. L. Schacht (pp. 107–117); (b) Standard Plate Method, by A. J. Powers (pp. 117–133); (c) The Direct Microscopic and Methylene Blue Reduction Methods for Grading Milk Samples, by J. L. Hileman (pp. 134–139); and (d) The Babcock Test, by A. C. Dahlberg (pp. 139–146); and Comparison of Composite Tests with Daily Tests, by D. S. Kochheiser (pp. 147–166).

The effect of cottonseed meal and alfalfa ration on the growth, vigor, breeding, and lactation of dairy heifers (*New Mexico Sta. Rpt. 1930, pp. 70–72, fig. 1*).—The abnormal appetites previously noted (E. S. R., 63, p. 472)

have continued after the heifers freshened. The breeding difficulties have also continued, and in lots 2, 3, and 4 especially blood tumors, cystic ovaries, and adhesions have caused considerable trouble. The daily production of heifers that have freshened has ranged from 36.1 to 51.7 lbs. of milk.

Cottonseed meal studies.—III, Heavy feeding of cottonseed meal to dairy cattle during reproduction and lactation, C. F. Huffman and L. A. Moore (*Jour. Dairy Sci., 13 (1930), No. 6, pp. 478–494, pl. 1, fig. 1*).—Continuing these studies (E. S. R., 62, p. 554) at the Michigan Experiment Station, the effect of heavy cottonseed meal feeding on health, reproduction, and milk production of dairy cattle for the first generation up to approximately 4 years of age was investigated. High-grade Holstein heifers were divided into 2 lots of 5 head each and fed a basal ration of yellow corn, corn silage, and timothy hay, to which was added either cottonseed meal or linseed meal.

There was no apparent harmful effect on health, reproduction, or lactation following the liberal feeding of cottonseed meal to these animals from 3 months to 4 years of age. The susceptibility to udder infection was not increased by heavy cottonseed meal feeding. These results further support the theory that cottonseed meal injury in dairy cattle is due to the deficiency of a factor or factors carried by good-quality hay.

Measuring the influence of hormone and mechanical stimulation by means of a non-fecund lactation, R. B. Becker and P. C. McGilliard (*Jour. Dairy Sci., 13 (1930), No. 5, pp. 372–379, figs. 2*).—A review of the literature and data obtained with a single case of nonfecund lactation in a Holstein-Friesian cow at the Oklahoma Experiment Station indicated that the internal stimulus produced by pregnancy and released at parturition was the largest factor in controlling maximum daily milk yield. The more rapid decline in milk flow in normal lactation was attributed to a gradual diminishing internal or hormone influence arising from reproduction. Maximum daily milk yield was attained later in lactation when influenced mainly by external mechanical stimulation from the act of milking. That the internal stimulus was not necessarily a factor in determining persistency of milk flow was indicated by the length of the lactation period. At the peak of production the amount of milk produced daily was from 3.5 to 5 times greater following normal reproduction than when mechanical stimulation induced the milk flow. A small part of this difference in milk flow was attributed to the fact that during normal lactation cows were milked 3 times daily.

The calcium and phosphorus metabolism of heavily milking cows, C. F. Huffman, C. S. Robinson, and O. B. Winter (*Jour. Dairy Sci., 13 (1930), No. 6, pp. 432–448*).—A series of calcium and phosphorus balances were conducted with grade Holstein cows at the Michigan Experiment Station. The balances were run when the cows were in heavy, medium, or low milk production and when dry. Three rations differing only in mineral content were used, and these rations were fed through several years so there was no question of the animals adapting themselves to a new diet.

The results showed that a ration of timothy hay, corn silage, and grain supplied sufficient calcium and phosphorus for the production of at least 10,000 lbs. of milk per year. During the height of production on this ration the cows were frequently in negative balance, but subsequent positive balances made up the losses. A cow producing 80 lbs. of milk per day on the above ration, supplemented with bone flour, showed positive calcium and prosphorus balances. On a ration of alfalfa, silage, and grain, positive calcium balances were obtained in heavily milking cows.

Cows fed a low calcium ration utilized calcium more efficiently than those on a ration high in this element, and there was a tendency for heavy milking cows to utilize both calcium and phosphorus more efficiently than low milking or dry cows. The total intake of calcium and phosphorus had a greater significance in the utilization of these elements than the calcium-phosphorus ratio.

Normal variations in the calcium content of the blood of dairy cattle, L. S. PALMER and C. H. ECKLES (*Jour. Dairy Sci., 13 (1930), No. 5, pp. 351–359, fig. 1*).—Continuing the studies of the blood of dairy cows (E. S. R., 64, p. 258) at the Minnesota Experiment Station, a biometric study was made of 60 sets of blood samples, each representing three consecutive days, taken at monthly intervals from August to December. The samples were taken from 24 different animals ranging in age from calves to mature cows and on various planes of calcium and phosphorus intake. The samples were drawn from the jugular vein and in practically all cases analyses were begun the day the samples were drawn.

It was found that the calcium content of the blood plasma was subject to significant fluctuations of an undetermined nature in spite of the high coefficient of correlation of calcium content on successive days. When the plasma calcium was relatively low any deviation in the calcium content from the theoretical value of blood samples taken on three successive days was negative, while when the plasma calcium was relatively high the deviation was positive.

The biometry of calcium and inorganic phosphorus in the blood plasma of dairy cattle, L. S. PALMER, R. A. GORTNER, and R. RUDE (*Jour. Dairy Sci., 13 (1930), No. 5, pp. 360–367*).—A biometric study based on the data obtained in the above study and in one previously noted (E. S. R., 64, p. 258) showed a high coefficient of correlation between the phosphate of the blood plasma of dairy cows on successive days and a fairly high coefficient of correlation for the calcium content during similar periods. No correlation was found between the calcium and inorganic phosphate in the blood plasma. The amount of calcium phosphate found in the blood had no biological significance.

Based on these results it was concluded that the mineralization of bone was not explainable on the basis of precipitation of bone salts from the blood plasma.

The fat of the blood and the fat of the milk during lactation [trans. title] C. PORCHER and L. MAYNARD (*Lait, 10 (1930), Nos. 96, pp. 601–613; 97, pp. 765–782*).—A study is reported of the total fatty acids and unsaponifiable matter in the blood plasma of dry and milking cows. These constituents exhibit only small variations from day to day and at different hours in the same day. While the values for fatty acids and unsaponifiable matter vary for different individuals, the ratio between them tends to remain constant. There is a parallel increase in both of these lipids following parturition. Variations of 100 per cent and more frequently occur in the percentage of fat in the milk obtained in consecutive milkings. Despite these large variations, the blood lipids studied rarely vary more than 20 per cent, and the average variation is much smaller. No correlation is evident between the percentage of fat in the milk and the level of blood lipids at the time the milk is being secreted.

A study of the bacterial content of the fore milk of cows, J. FABER (*Jour. Dairy Sci., 13 (1930), No. 6, pp. 449–452*).—In this study at the Maryland Experiment Station the udders of the cows were washed and dried before taking the milk samples. Each sample was a mixture of four streams, one from each quarter of the udder. Five such samples were obtained and considered the foremilk. The next five streams from each quarter were discarded, and the eleventh stream was used as a sample of middle milk. The samples were stored at from 40 to 44° F. for 18 hours before plating on standard beef extract agar,

The average bacterial count of stream 1 was 1,275 per cubic centimeter; of stream 5, 551 per cubic centimeter; and of stream 11, 449 per cubic centimeter. The reduction in bacterial count between streams 5 and 11 was slight, and the results indicate that the discarding of the first five streams as foremilk was advisable only because they carried increased numbers of bacteria.

Effect of the Electropure process and of the holding method of treating milk upon bacterial endospores, A. J. Gelpi, jr., and E. D. Devereux (*Jour. Dairy Sci., 13 (1930), No. 5, pp. 368–371*).—A series of tests were conducted at the Michigan Experiment Station to compare the relative resistance of spore-forming organisms to the Electropure and holding methods of pasteurization. Cultures from 6 to 8 weeks old and containing from 80 to 90 per cent of spores were used. In the case of *Bacillus anthracis* the percentage reduction by the holding method ranged from 0.3 to 2.7 and by the Electropure process from 99.5 to 99.7. Similar results were obtained with *B. subtilis, B. mycoides, B. mesentericus*, and *B. megatherium*.

These results showed that spore destruction by the Electropure process at 71° C. with momentary holding was superior to pasteurization at 62.8° for 30 minutes.

Corrosion of metals by milk and its relation to the oxidized flavors of milk, E. S. Guthrie, C. L. Roadhouse, and G. A. Richardson (*Hilgardia [California Sta.], 5 (1931), No. 14, pp. 425–453, figs. 3*).—Continuing this study (E. S. R., 60, p. 865), it was found that the metals, copper and the copper alloys (ambrac, brass, bronze, Monel metal, nickel silver, and Waukesha metal) lost weight when exposed to sweet milk and produced oxidized flavors in the milk. Tin-plated copper or copper alloys, because of the mechanical wearing away of the plating, were unsatisfactory, and chromium-plated copper was even less satisfactory for the same reason. Pure nickel showed high weight losses and became badly clouded when exposed to sweet milk, and often caused oxidized flavors in the milk. The chromium alloys, Ascoloy and Enduro A, showed little or no losses in weight and remained clear in appearance, but in certain milks produced slight oxidized flavors. The chromium-nickel alloys, Enduro Nirosta KA2 and allegheny metal when well polished, pure aluminum, glass enamel, and carefully tin-plated metals, showed little or no losses in weight, remained clear in appearance, and produced no oxidized flavors when exposed to sweet milk.

It was also shown that aeration of milk during pasteurization increased the tendency to develop oxidized flavors.

The vitamin A content of the milk of Holstein, Ayrshire, Jersey, and Guernsey cows, H. P. Davis and I. L. Hathaway (*Nebraska Sta. Research Bul. 54 (1931), pp. 14*).—Concluding this study (E. S. R., 63, p. 669), the vitamin A content of the milk of the four leading breeds of dairy cattle was compared by studying the growth of 560 rats, which were fed milk from these cows as their only source of vitamin A. The rats were fed a vitamin A deficient diet from weaning time until ophthalmia was incipient or until there was a cessation of growth. At this point the basal ration was supplemented with 1, 2, and 3 cc. of milk. Both negative and positive controls were used to check the results.

Although the results showed some slight irregular differences in the gains of the different groups of rats, when viewed in respect to individual variations and subjected to statistical analyses these differences were negligible. It was evident from the results of the study that the differences in the vitamin A

content of the milk from Holstein, Jersey, Ayrshire, and Guernsey cows were insignificant.

Seasonal variations in certain inorganic constituents of dry milk produced in New York and Wisconsin, G. C. Supplee (*Jour. Dairy Sci., 13 (1930), No. 6, pp. 522–527, figs. 2*).—In this paper the author submits analytical data showing the natural fluctuations of certain inorganic constituents of dry milk as affected by seasonal and territorial conditions in the States of New York and Wisconsin.

Air in butter, E. S. Guthrie (*Jour. Dairy Sci., 13 (1930), No. 6, pp. 461–470, figs. 2*).—A number of determinations were made of the amount of air in butter at the New York Cornell Experiment Station in a study of the effect of working on the percentage of air. Samples were taken of butter that had been worked sufficiently to prevent the formation of mottles and which contained fairly large droplets of incorporated water and from the same lots of butter that were thoroughly worked.

There was an average increase of air content in the butter, due to working, of 0.701 per cent. The lowest increase was 0.227 per cent and the largest increase 2.521 per cent. In two samples there was a decided decrease in the percentage of air due to working. The variation in air content under certain conditions may be sufficient to affect materially the procedure of packing butter that is fairly well worked and that which is thoroughly worked, since print butter is packed by volume and sold by weight.

Relation between titratable acidity and hydrogen ion concentration of ice cream mixes, C. D. Dahle, W. K. Budge, and J. I. Keith (*Jour. Dairy Sci., 13 (1930), No. 6, pp. 417–423, figs. 4*).—Studies at the Pennsylvania Experiment Station showed that the titratable acidity of an ice cream mix was not a true indication of the amount of lactic acid present. The results obtained for titratable acidity were meaningless unless the serum solid content was known. Even a knowledge of the serum solid content of a mix and of its titratable acidity was not sufficinet to determine the correct point to which the acid should be standardized.

The effect of initial cooling temperature on gelatin in the aging of the ice cream mix, K. E. Wright (*Jour. Dairy Sci., 13 (1930), No. 5, pp. 406–415, figs. 2*).—Ice cream mixes varying in fat from 10 to 15 per cent and in serum solids from 9 to 10 per cent, containing 15 per cent sugar and 0.35 per cent gelatin, were used in this test at the Massachusetts Experiment Station. The mixes were pasteurized at from 149° to 151° F. for 30 minutes and homogenized at 2,500 lbs. pressure. The mixes were cooled over a surface cooler to temperatures varying by 20° from 40° to 160° and allowed to cool without agitation for 24 hours in a 40° cold room. Viscosity determinations were then made at 68° with a MacMichael viscosimeter.

The results indicate that a greater part of the texture benefits derived from aging ice cream mixes were associated with the viscosity imparted by gelatin. A high initial temperature during the aging period favored the development of greater basic viscosity. Maximum viscosity was obtained when a mix was allowed to cool from 80–100° to 40° without agitation. As viscosity increased, the whipping properties of a mix decreased. Increased viscosity decreased the rate of melting down and also influenced the manner of melting down. This study shows that the results of aging an ice cream mix may be dependent upon factors affecting the crystallization of the gelatin portion.

A new form of lactose crystal found in sandy ice cream, O. E. Williams and P. N. Peter (*Jour. Dairy Sci., 13 (1930), No. 6, pp. 471–477, figs. 8*).—A

crystal of unusual shape was found in ice cream containing 12 per cent butterfat, 16 per cent sugar, 12 per cent serum solids, and 0.3 per cent gelatin that had been held in the hardening room for about 5 weeks by the U. S. D. A. Bureau of Dairy Industry. The crystals were first examined crystallographically, and later chemical and other physical tests for their identification were made.

These diamond-shaped crystals were identified as α-lactose hydrate. It was thought that the occurrence of this modified form of lactose crystal was due to the high viscosity of the solution, caused by the concentration of sucrose in the crystallizing medium, which in turn was caused by the freezing out of a part of the water. The relatively large size of the crystals and their quantity indicated that to avoid sandy ice cream of this nature, the viscosity of the solution as well as the solubility relationships of lactose must be considered. To prevent diffusion and the growth of these large lactose crystals, it is recommended that ice cream be kept frozen hard or approximately so.

VETERINARY MEDICINE

Annual report of the Veterinary Department, Northern Provinces, for the year 1929, W. W. Henderson and G. N. Hall (*North. Provs.* [*Nigeria*] *Vet. Dept. Ann. Rpt. 1929, pp. 84, pls. 8*).—This report (E. S. R., 63, p. 871) deals with the occurrence of and work with infectious diseases of cattle (pp. 9–34), equines (pp. 34, 35), sheep and goats (pp. 35–40), and dogs (p. 40). A report of work at the veterinary laboratory at Vom follows (pp. 47–84).

Annual report of the department of veterinary science and animal husbandry for the year ending 31st December, 1929, F. J. McCall et al. (*Tanganyika Ter. Dept. Vet. Sci. and Anim. Husb. Ann. Rpt. 1929, pp. 76, pls. 15*).—Part 2 of this report (pp. 3–16) deals with the occurrence of and work with infectious diseases of livestock during the year, and part 3 (pp. 17–54) with the work of the veterinary laboratory at Mpwapwa, including diagnosis, serum production, treatment of disease, veterinary-entomological research, notes on strongylosis, etc.

The coagulation period of the blood of normal and diseased animals, A. Haag (*Die Gerinnungsdauer des Blutes bei Gesunden und Kranken Tieren. Inaug. Diss., Ambul. Univ.-Tierklin., Leipzig, 1929, pp. 42+[3]*).—The average coagulation periods for the normal animals studied were for 4 horses 8.5 minutes, 17 bovines 4.35 minutes, 2 sheep 4 minutes, 12 swine 2.33 minutes, 1 dog 1 minute, and 4 pigeons 52.5 seconds. The coagulation period of the blood of equines representing 24 types of disease and of bovines with 17 types of disease are reported upon in tabular form.

Pathology of the neurotropic virus diseases of the domestic animals (with regard to comparative pathology) [trans. title], O. Seifried (*Ergeb. Allg. Path. Mensch. u. Tiere, 24 (1931), pp. 554–676, figs. 48*).—The subject is dealt with under the headings of encephalomyelitis (1) with elective neurotropic (pp. 564–632) and (2) with organotropic characteristics of the virus (pp. 632–676). Under the former group are considered infectious cerebrospinal meningitis (Borna disease) of the horse and of the sheep, enzootic encephalitis of bovines, rabies, paralysis in guinea pigs, and their comparative pathology, etiology, and pathogenesis. Under the latter group the author takes up enzootic encephalomyelitis of the horse, Froehner-Dobberstein's cerebro-spinal meningitis of the horse, dog distemper—encephalitis, hog cholera—encephalitis, fowl pest—encephalitis, infectious paralysis of the fowl, and the comparative pathology, etiology, and pathogenesis of this group.

A bacteriophage for B. anthracis, P. B. Cowles (*Jour. Bact., 21 (1931), No. 3, pp. 161–166*).—The author reports having obtained from sewage a bacter-

iophage highly potent for *B[acillus] anthracis*. All of the typical anthrax strains studied, 11 in number, were susceptible to its action. It was found possible to develop resistant strains of *B. anthracis* in which the resistance is carried through the spore stage and maintained through repeated pasturizations. The occurrence of secondary growth, with the strain of *B. anthracis* used in these experiments at least, seems to be dependent upon the number of organisms subjected to the lytic principle.

Bureau of Animal Industry researches on infectious abortion, W. E. Cotton and J. M. Buck (*Jour. Amer. Vet. Med. Assoc., 78 (1931), No. 3, pp. 306–325*).—This is a review of the work of the experiment station of the U. S. D. A. Bureau of Animal Industry at Bethesda, Md., presented at the annual meeting of the U. S. Live Stock Sanitary Association in December, 1930.

The acidity produced in Brucella cultures, S. H. McNutt and P. Purwin (*Jour. Infect. Diseases, 48 (1931), No. 3, pp. 292–294*).—This is a report of a study made of some of the characteristics of the Brucella group of microorganisms in a carbohydrate medium. "Broth or peptone solution in which Brucella was grown without sugar became strongly alkaline. When dextrose, levulose, galactose, xylose, or arabinose was added, the medium still became alkaline even though determinations of sugar showed a loss. When sugars were added to a solution of nutrose or a mixture of nutrose solution and serum, and the medium was inoculated with Brucella, very evident traces of acid were often produced in dextrose, levulose, galactose, and xylose. With arabinose, greater quantities of acid were formed. When Brucella was limited to a sugar as the only source of carbon, experiments indicated that growth took place in both arabinose and xylose. It was impossible to classify the strains according to source when grown in carbohydrate mediums."

Lethal temperatures for Br. abortus with special reference to pasteurization, C. M. Carpenter and R. A. Boak (*Jour. Bact., 21 (1931), No. 1, p. 54*).—In reporting further upon the lethal temperatures for *Brucella abortus* (E. S. R., 60, p. 267), 122 samples of raw market milk were collected from 67 villages and 2 cities and examined for *B. abortus* infection. Evidence of *B. abortus* infection was found in 20.4 per cent of the samples when 2 cc. of the cream from each sample was injected subcutaneously into guinea pigs. Two hundred and five samples of pasteurized milk and cream collected in 38 cities and 12 villages and examined for evidence of *B. abortus* by guinea pig injection were negative. Temperatures of 142° and 145° F. for 20 and 30 minutes on the most virulent strains of *B. abortus* were found satisfactory for pasteurizing milk.

Copper sulphate medium for the isolation of Br. abortus (Bang) from milk, I. F. Huddleson (*Jour. Bact., 21 (1931), No. 1, p. 53*).—In work at the Michigan Experiment Station it has been found necessary to use the gravity cream layer in order to isolate *Brucella abortus* from raw market milk. "If streptococci are present in the market milk, they are also concentrated in the cream layer. When the cream is cultured, they grow out rapidly and lower the pH of the medium. *B. abortus*, if present, will not grow. Streptococci fail to grow out on beef liver infusion agar, pH 6.6, containing gentian violet in a dilution of 1:200,000 and copper sulfate solution in a final dilution of 1:2,200, while *B. abortus* (Bang) is not inhibited."

The agglutination titre of milk as an indicator of the presence of Bact. abortus in milk, H. L. Gilman (*Jour. Bact., 21 (1931), No. 1, pp. 53, 54*).—In the work reported the milk from all four quarters of 68 cattle was examined for agglutinin content and injected into guinea pigs for evidence of *Bacterium abortus* infection. This organism was not recovered from milk showing agglutinins under positive at 1:80, nor from an animal with a lower blood titer than positive at 1:320. *B. abortus* was recovered from 59 per cent of the milk from

quarters showing agglutinins in dilutions of positive at 1:80 or higher. It is tentatively assumed that quarters showing agglutinins positive at 1:80 or above are actively infected with *B. abortus* and may eliminate the organism at any time. Cultures showing agglutinins under 1:80 only in rare instances retain or eliminate the organism. It is considered that composite milk samples from all four quarters are unsuitable for use in the agglutination test.

Types of Br. abortus isolated from human, bovine, porcine, and equine sources, W. N. PLASTRIDGE and J. G. MCALPINE (*Jour. Bact., 21 (1931), No. 1, pp. 52, 53*).—In work at the Connecticut Storrs Experiment Station, 265 strains of *Brucella abortus* isolated from human, bovine, porcine, and equine sources have been identified by the dye plate method noted by Huddleson and Abell (E. S. R., 60, p. 666) and by the glucose utilization method of McAlpine and Slanetz (E. S. R., 58, p. 875). Of 129 strains of human origin isolated from cases of undulant fever occurring in the United States and Europe, 66 were classified as belonging to the porcine type and 63 to the bovine type. Of 60 strains of bovine origin isolated in the United States from cattle, 8 were classified as belonging to the porcine type and 52 to the bovine type. Of 22 strains of porcine origin, all were identified as belonging to the porcine type. Of 4 strains of equine origin, all possessed the differential characteristics of the bovine type.

The results obtained by the dye plate and glucose utilization methods were in close agreement.

Eimeria bukidnonensis, a new coccidium from cattle, and other coccidial parasites of domesticated animals, M. A. TUBANGUI (*Philippine Jour. Sci., 44 (1931), No. 3, pp. 253–271, pls. 2*).—Cases of coccidiosis in cow and carabao calves and in pups are reported, as are cases in two adult cats which were apparently only carriers of coccidial parasites but came down with acute symptoms when infected experimentally with the surra trypanosome (*Trypanosoma evansi*).

"Presuming that young animals derive their infections from their infected mothers and other adult animals that play the rôle of carriers, a survey was made among the different domesticated animals and the oocysts of the following coccidial parasites were encountered: *E. zürnii*, *E. smithi*, and a new species, *E. bukidnonensis*, in cattle; *E. zürnii* and *E. smithi* in carabaos; *E. faurei* in sheep and goats; *E. debliecki* in swine; *E. canis* and *Isospora rivolta* in dogs; *Isospora* sp. in cats; *E. tenella* in chickens. These various coccidia appear to be morphologically distinct, and the differentiation of their oocysts is facilitated by means of a table."

The pathogenic streptococci: The rôle of the streptococci in scarlet fever, D. and R. THOMSON (*Ann. Pickett-Thomson Research Lab., 6 (1930), pp. XIII+470, pls. 13, fig. 1*).—This is in continuation of the work previously noted (E. S. R., 64, p. 474).

Relapsing fever in central Texas, B. WELLER and G. M. GRAHAM (*Jour. Amer. Med. Assoc., 95 (1930), No. 24, pp. 1834, 1835*).—This is an account of the occurrence of relapsing fever in several boys who had explored a cave in the Colorado River valley in Texas about 75 miles above Austin. Ticks (*Ornithodoros turicata*) collected from the cave caused the death of rabbits to which they were applied, and spirochetes were found in the peripheral blood.

On the development of Trypanosoma evansi in the mouse [trans. title], B. J. KRIJGSMAN (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Veeartsenijk. Meded., No. 76 (1930), pp. 65, figs. 12; Ger., Eng. abs., pp. 62–65*).—This first report of a proposed series of investigations of the development of the surra trypanosome *T. evansi* in different species of mammals is presented in connection with a list of 75 references to the literature.

[Contributions on tuberculosis of livestock] (*Jour. Amer. Vet. Med. Assoc., 78 (1931), No. 3, pp. 371–377, 378–396, 399, 400, 401–409, 437–442*).—The contributions on tuberculosis presented at the annual meeting of the U. S. Live Stock Sanitary Association in December, 1930, include the following: Remarks on Avian Tuberculous Infection in Mammals, by L. Van Es (pp. 371–377); Present Status of Cooperative Tuberculosis Eradication Campaign in the United States, by A. E. Wight (pp. 378–385); Newer Aspects of the Prevention of Tuberculosis, by J. A. Myers (pp. 385–396); Report of Committee on Tuberculosis, by T. E. Munce et al. (pp. 399, 400); The Importance of Sanitation in the Prevention and Control of Bovine Tuberculosis, by C. L. Hill (pp. 401–409); and Avian Tuberculosis, by A. F. Schalk (pp. 437–442).

The occurrence of tularemia in British Columbia, R. R. Parker, E. Hearle, and E. A. Bruce (*Pub. Health Rpts. [U. S.], 46 (1931), No. 2, pp. 45, 46*).—The authors report the isolation of *Bacterium tularense* McCoy from the snowshoe rabbit (*Lepus americanus columbiensis* Rhoades) near Vavenby, B. C., in May, 1930. It is pointed out that the first diagnosed case of tularemia in Canada was reported by A. L. McNabb in February, 1930, in a miner living near Timmins, Ont.[3] The occurrence of this affection in two localities over 1,500 miles apart suggests the probability that the disease in the Canadian fauna is widespread and of many years' standing.

A report was received by the authors that snowshoe rabbits whose livers were spotted were observed at Salmon Arm, B. C., in 1921; also that "rabbit cycles" had been a familiar phenomenon observed in Alberta, and that during epidemic years there had been an unusual amount of sickness among the resident settlers, by whom jack rabbits were commonly used as food.

The result of agglutination tests of blood from animals on farms where cases of undulant fever occur, C. Murray, S. H. McNutt, and P. Purwin (*Jour. Amer. Vet. Med. Assoc., 78 (1931), No. 3, pp. 339–343*).—The authors report upon the occurrence of Brucella infection in cattle and hogs throughout the State of Iowa, estimated by agglutination tests of animals from herds on farms where undulant fever has occurred as compared with those from the killing floors of a large packing plant. A higher percentage of infection was found in livestock on farms where cases of undulant fever were involved. No reactors in either cattle or hogs were found on 29 per cent of the undulant fever farms, suggesting the possibility of some other source of infection. The data obtained indicate that Brucella infection in swine is more dangerous to man than infection in cattle.

Bone-chewing or depraved appetite in cattle, C. H. Eckles, L. S. Palmer, and T. W. Gullickson (*Minn. Univ. Agr. Ext. Spec. Bul. 132 (1930), pp. 6, figs. 3*).—A practical account.

Some possible factors associated with the parathyroid deficiency theory of the aetiology of milk fever, W. P. Blount (*Vet. Rec., 11 (1931), No. 12, pp. 302, 303*).—A brief discussion, presented in connection with a list of 21 references to the literature.

A problem in the coagulation of the blood, "sweet clover disease of cattle," L. M. Roderick (*Amer. Jour. Physiol., 96 (1931), No. 2, pp. 413–425, fig. 1*).—This contribution from the North Dakota Experiment Station reports upon studies made of the alterations in the blood concerned in the coagulation process which take place in sweetclover disease, the losses from which, due to hemorrhage, result from the feeding of damaged sweetclover hay and silage (E. S. R., 63, p. 870).

Analytical work with the blood of a series of animals that were fed on damaged sweetclover indicates that there may be some depression in the blood

fibrinogen during the feeding trials, although the values obtained were within the probable error of a series of determinations on normal cattle. It was found that the delayed coagulability of the blood in sweetclover disease involves a reduction in the prothrombin, and that the diminution parallels the delay in the coagulation time.

"No experimental evidence has been found to indicate that the delay in the coagulation time is due to the increase of an inhibitory principle of the nature of heparin or antithrombin. Estimation of the blood calcium, together with other studies, show that this condition is neither caused by nor does it involve a deficiency in the metabolism of calcium. The progressive decrease in the quantity of available prothrombin in the blood of animals fed on the damaged sweetclover seems to be quite independent of the number of platelets present, which remains at about the normal level until hemorrhage occurs. The treatment of many animals which have shown the effects of serious hemorrhage by the intravenous injection of freshly defibrinated normal bovine blood has resulted in a large proportion of recoveries."

Carbon tetrachloride poisoning in cattle, W. L. STEWART (*Vet. Rec.*, *11* (*1931*), *No. 11*, *p. 283*).—The author records a mortality in several head of cattle to which a dose of approximately 4 cc. of carbon tetrachloride was accidentally administered.

Studies in Brucella melitensis (abortus) infection of cattle, C. A. MITCHELL and F. A. HUMPHREYS (*Cornell Vet.*, *21* (*1931*), *No. 1*, *pp. 57–67*).—It was found in a positive reacting herd composed of 16 animals that 12 excreted *B. melitensis* (*abortus*) from one or more quarters of their udders, 2 animals having one quarter infected, 3 animals having two quarters infected, 5 having three quarters infected, and 2 having four quarters infected. "The right front was infected in 6 instances, the right rear in 9, the left rear in 10, and the left front in 6. In each case the milk from the infected udder reacted to the agglutination or the complement fixation test, usually to both. In each case where agglutinins and complement fixing substances were absent, guinea pig inoculation was negative. In several instances the milk reacted to both tests but organisms were not demonstrated. Guinea pigs that had present in their blood on the first bleeding only one of the two antibodies (complement fixing or agglutinins) with one exception presented complement fixing substances first, the agglutinins appearing later."

The details of blood reactions are reported in tabular form.

Economic factors of abortion in cattle, L. H. RICH (*Cornell Vet.*, *21* (*1931*), *No. 1*, *pp. 15–24*).—This account is based upon production and breeding records of the University of Minnesota dairy herd and a branch station herd, together with a questionnaire representing 131 replies of purebred breeders.

Studies on contagious streptococcic mastitis, J. M. ROSELL (*Cornell Vet.*, *21* (*1931*), *No. 1*, *pp. 80–85*).—In a study of 380 cases of mastitis in cows in Quebec, the fresh milk of which gave a pH of from 6.2 to 6.6, 88 per cent showed no indications of mastitis by other tests. It is considered that a pH between 6.2 and 6.6 indicates absence of disease in nearly 90 per cent. In 8 per cent of the other quarters, with a pH of from 6.2 to 6.6, there was a pathological increase of catalase. In 16 per cent of the samples showing a pH below 6.6 the chlorine was above 0.14 per cent. The increased pH was not always proportional to the increased sediment. The cause for these disagreements could not be determined.

Melioidosis, with special reference to the dissociation of Bacillus whitmori, L. NICHOLLS (*Brit. Jour. Expt. Path.*, *11* (*1930*), *No. 6*, *pp. 393–399*, *figs. 8*).—A splenic abscess in a cow due to *B. whitmori* is reported upon. The

rough and smooth growths of this organism are described, together with an account of its production of oxalates.

A study of avian tuberculosis in cattle, N. Plum (*Cornell Vet., 21 (1931), No. 1, pp. 68–76*).—The details of this study, conducted at the serum laboratory of the Royal Danish Veterinary and Agricultural High School, are presented in tabular form.

Experimental enzootic encephalo-myelitis of sheep and cattle (Borna disease) (second memoir) [trans. title], S. Nicolau and I. A. Galloway (*Ann. Inst. Pasteur, 44 (1930), No. 6, pp. 673–696, fig. 1; abs. in Trop. Vet. Bul., 18 (1930), No. 4, p. 138*).—This second contribution by the authors on Borna disease (E. S. R., 60, p. 476) deals with the tenacity of the virus; the effect of H-ion concentration on the tenacity and the virulence of the organism in physiological salt solution at room temperature; a study of the virus in liquid culture media in which virulent brain fragments were placed; dilutions at which the virus obtained from the brains of rabbits which succumbed to experimental infection are virulent; adsorption; attempted neutralization of the virus in vitro with the aid of hepatic extract; viruliclde in vitro of potassium permanganate; and the action of stovarsol in vitro.

It was found that in the dried state the virus remains virulent at laboratory temperature for more than 327 days, at room temperature in cow's milk for at least 100 days, and in tap water at room temperature for at least 30 days.

Experimental enzootic encephalo-myelitis of sheep and cattle (Borna disease (third memoir) [trans. title], S. Nicolau and I. A. Galloway (*Ann. Inst. Pasteur, 45 (1930), No. 4, pp. 457–523, figs. 9*).—In continuation of the work with Borna disease above noted, the authors report on (1) the pathogenic action of the virus as determined through inoculation of the monkey, fowl, guinea pig, cat, dog, and rabbit; (2) a study of cases of autosterilized neuroinfections of animals experimentally infected with the virus of Borna disease in the rabbit, horse, sheep, and monkey; (3) anatomical pathology; and (4) immunity.

Brucella abortus agglutinins in the blood of sows slaughtered in Toronto, R. Gwatkin (*Cornell Vet., 21 (1931), No. 1, pp. 77–80*).—In the examination of 500 samples of blood from sows slaughtered at an abattoir in Toronto it was found that 3 reacted positively to *B. abortus* and 4 were suspicious.

Experiments on hog cholera and dog distemper, J. W. Benner (*Cornell Vet., 21 (1931), No. 1, pp. 1–14*).—The author concludes that young pigs farrowed by and suckling a cholera immune sow derive their passive immunity to cholera prenatally or through the colostrum and not through the milk. Fresh mixtures of hyperimmune serum and virus have satisfactorily immunized and have not been found to be of an infectious nature. A clear, concentrated hyperimmune serum of high potency can be produced by the simple process of passing it through a continuous flow blood separator. The residue obtained by this separation constituted 32 per cent in tail-bled serum and 49 per cent in throat-bled serum. When tested, the residue had no immunizing value.

Formolization of spleen pulp and blood from animals sick with the disease gives some promise of another method of immunization against hog cholera. An avirulent commercial canine distemper virus produced no noticeable reaction in swine. A virulent experimental strain, when injected and when fed, produced a marked reaction resembling swine influenza. This virus seemed to be transmissible to man, either directly or through the medium of the hogs and dogs upon which it was used. Hog cholera virus seems to have no disease-producing power in dogs. Dog distemper virus produced no immunity in hogs against hog cholera.

Dog distemper antiserum, P. P. Laidlaw and G. W. Dunkin (*Vet. Rec., 11 (1931), No. 14, pp. 359–367, figs. 4*).—In this further report of work (E. S. R., 62, p. 265), the authors consider some of the properties of distemper antiserum and describe a method by which immunity may be induced in susceptible dogs, namely, by the use of a hyperimmune homologous serum and living virus.

Do saprophytic and secondary bacteria occurring in the respiratory tracts of domestic fowl in infectious trachitis and in health produce agglutinins in the blood? C. S. Gibbs (*Jour. Bact., 21 (1931), No. 1, p. 45*).—In work at the Massachusetts Experiment Station, 61 cultures consisting of staphylococci, Escherichia, micrococci, streptococci, Alcaligenes, Eberthella, and Pasteurella were isolated from the respiratory tracts of 12 fowls suffering from acute infectious tracheitis and of 10 healthy fowls not immune to infectious tracheitis. The agglutination tests were made in dilutions extending from 1:8 to 1:2,040, the range of titer in the tests being found to vary from 0 to 1,024 without showing any specificity other than what could have been classified as natural or spontaneous agglutination. While great variations existed among different serums in aglutination titer, the results demonstrated that saprophytic and secondary bacteria in the respiratory tracts of domestic fowls were of little importance in producing agglutinins in the blood.

Coccidiosis in chickens, H. L. Richardson (*Maine Agr. Col. Ext. Bul. 194 (1931), pp. 19, figs. 9*).—A practical account.

Fowl leucemia, E. L. Stubbs (*Jour. Amer. Vet. Med. Assoc., 78 (1931), No. 3, pp. 434–437*).—This is a report of studies of a disease of the fowl, characterized by an enlargement of the liver, the spleen, and sometimes the kidneys and other tissues, in which it was established that true leukemia exists among fowls and that it can be transmitted from fowl to fowl.

Studies of this disease by Durant have also been noted (E. S. R., 65, p. 72).

A comparison of the inclusion bodies of fowl-pox and molluscum contagiosum, E. W. Goodpasture and C. E. Woodruff (*Amer. Jour. Path., 7 (1931), No. 1, pp. 1–8, pl. 1*).—The authors find that "the inclusion bodies of molluscum contagiosum may be freed from surrounding cellular material by tryptic digestion. Unlike fowl pox inclusions, the molluscum bodies are found to be sticky and gelatinous after they have been digested. Because of this characteristic they can not be manipulated readily with the Chambers microdissection apparatus. The gelatinous matrix of the molluscum bodies has a markedly granular appearance due to the presence within it of myriads of Lipschütz granules—minute coccoid structures 0.25μ in diameter. These granules are identical in size, shape, and staining reactions with the Borrel bodies of fowl pox. They are resistant to the action of trypsin.

"The inclusion bodies of molluscum, on being placed in distilled water, show little or no swelling. Under similar conditions the fowl pox inclusions swell markedly, due, probably, to their lipoid material acting as a semipermeable membrane. Trituration of the molluscum inclusions readily breaks them up into the component Lipschütz granules. Fowl pox inclusions, similarly treated, fail to break up so readily into Borrel bodies. This difference in the reaction of molluscum and fowl pox to trituration may afford an explanation for the relatively greater filtrability of the former.

"Fowl pox and molluscum contagiosum are apparently specific for fowls and man, respectively, cross inoculation experiments having proved unsuccessful. Attempts to transfer molluscum to monkeys and other laboratory animals were also unsuccessful."

Fowl paralysis and the "roup complex," H. J. Stafseth (*Jour. Amer. Vet. Med. Assoc., 78 (1931), No. 3, pp. 423–429*).—This is a discussion presented at the 1930 meeting of the U. S. Live Stock Sanitary Association.

Pullorum disease, H. BUNYEA (*Jour. Amer. Vet. Med. Assoc., 78 (1931), No. 3, pp. 430–434*).—A contribution presented at the annual meeting of the U. S. Live Stock Sanitary Association in December, 1930.

An apparently new respiratory disease of baby chicks, A. F. SCHALK and M. C. HAWN (*Jour. Amer. Vet. Med. Assoc., 78 (1931), No. 3, pp. 413–422*).—This is a contribution from the North Dakota Experiment Station on an apparently new acute and quite fatal respiratory disease of baby chicks which was of common occurrence in North Dakota in April, 1930, and appears to have been encountered also in Mississippi, Louisiana, Ohio, Illinois, Nebraska, Iowa, and South Dakota. It appeared as an acute and highly contagious disease of baby chicks from 2 days to 3 weeks of age, an overwhelming majority manifesting first symptoms from 5 to 9 days after hatching. While pullorum disease was a complicating factor in certain lots of chicks under investigation, several broods were met with in which this organism was not present. Bacteriological studies and experimental exposures, including exposure of baby chicks and adult fowls to Berkefeld filtrates, are reported.

Botulism and ducks (*Jour. Amer. Med. Assoc., 96 (1931), No 11, pp. 864, 865*).—This discussion of the subject, in which particular reference is made to the reports of Kalmbach (E. S. R., 64, p. 776) and of Giltner and Couch (E. S. R., 64, p. 776) includes several additional references to the literature on the subject.

The internal parasites of poultry in Quebec, A. D. BAKER (*Sci. Agr., 11 (1930), No. 3, pp. 150–158, figs. 6*).—This is a report of a survey of the internal parasites of chickens in the Province of Quebec made with the assistance of the National Research Council of Canada.

The parasites, parasitic diseases, and other diseases of fur animals, L. FREUND (*Die Parasiten, Parasitären und Sonstigen Krankheiten der Pelztiere. Hanover: M. & H. Schaper, 1930, pp. VII+229, figs. 70; rev. in Jour. Amer. Vet. Med. Assoc., 78 (1931), No. 1, pp. 105–107*).—Following an introduction and discussions of general pathognostic and general therapy, the author deals with the parasites and parasitic diseases (pp 11–140) and other affections (pp. 140–222) of fur-bearing animals. General and specific bibliographies, with 364 references, are included. The review is by M. C. Hall.

The relation of streptococci to the filtrable virus of epizootic encephalitis of the fox, E. C. ROSENOW (*Jour. Infect. Diseases, 48 (1931), No. 3, pp. 304–334, figs. 12*).—The author reports the consistent isolation of a streptococcus with distinctive cultural, serologic, and neurotropic properties from the brains of young foxes and dogs, less commonly from the brains of rabbits, which had succumbed to encephalitis following the inoculation of virus. "The characteristic symptoms and lesions that occur following intracisternal inoculation of the virus have been closely simulated following similar injection of properly gaged doses of a streptococcus that has passed through few to many rapidly repeated subcultures. From one strain of the streptococcus isolated from the brain of a dog that succumbed to virus and after many (33) subcultures, a filtrable virus seemingly has been produced."

The conclusion that the streptococcus isolated has etiologic significance in this disease of the fox and that it gives rise to the filtrable virus is considered warranted.

The meningo-encephalomyelitis of the squirrel (Sciurus vulgaris L) affected with coccidiosis [trans. title], B. GALLI-VALERIO (*Schweiz. Arch. Tierheilk., 72 (1930), No. 12, pp. 525–528*).—The author has found *Eimeria sciurorum* to produce a meningo-encephalomyelitis as well as an enteritis in the common European squirrel (*S. vulgaris*), the mortality caused occurring particularly in young squirrels. The pathology is similar to that found by the author to be

AGRICULTURAL ENGINEERING

[Irrigation investigations at the New Mexico Station] (*New Mexico Sta. Rpt. 1930, pp. 92–103*).—Progress results on the projects previously noted (E. S. R., 63, p. 482) are reported briefly, mostly without conclusions.

Experiments at Deming to determine the effect of frequency of irrigation and the quantity of water used on the yield of potatoes showed an increase in yield of No. 1 and No. 2 potatoes with the number of irrigations. It was concluded that this may have been partially due to the greater frequency of applications.

A comparison of flood and furrow irrigation for cotton indicated that there was no difference in the stand and little if any effect on the percentage of lint. The staple length, the bolly yield, and the rate of maturity were practically the same under both treatments. The total yield was slightly larger in the plats irrigated by the furrow method, this condition being opposite to that obtained during the previous year.

Making rapid field examinations of flood-control reservoir sites, J. A. Holmes (*Engin. News-Rec., 106 (1931), No. 10, pp. 386–388, figs. 4*).—Methods used to secure physical and economic data on 14 dams and 6 river systems in the Mississippi River valley are described.

Flow of ground-water as applied to drainage wells, M. R. Lewis (*Amer. Soc. Civ. Engin. Proc., 57 (1931), No. 3, pp. 411–423, figs. 8*).—In a contribution from the Oregon Experiment Station and the U. S. D. A. Bureau of Public Roads, three types of wells are discussed, including artesian wells (not necessarily flowing) with a perforated casing extending through the water-bearing stratum, wells in which the water table is in the water-bearing stratum and which penetrate its full depth, and open-bottom wells, that is, wells which just reach the water-bearing stratum.

Cases in which the zone of influence is either definite or indefinite are considered for each type, and formulas for the draw-down curves of each of these types of wells are derived. The conclusion is drawn that if the area to be drained is more than a few hundred feet in diameter, successful drainage will depend on a general lowering of the water table. To secure this lowering, wells should be designed to have the greatest possible capacity with an economical lift. Such capacity may be secured most readily, where conditions are favorable, by deep wells.

The column analogy, H. Cross (*Ill. Univ., Engin. Expt. Sta. Bul. 215 (1930), pp. 78, figs. 27*).—The object of this bulletin is to present some theorems dealing with the elastic analysis of continuous frames. The general conception referred to includes the principles of area moments and also the conception of the conjugate beam.

It is shown that bending moments in arches, haunched beams, and framed bents may be computed by a procedure analogous to the computation of fiber stresses in short columns subject to bending, and that slopes and deflections in these structures may be computed as shears and bending moments, respectively, on longitudinal sections through such columns. The theorem makes available for the analysis of plane elastic structures the literature of beam analysis, dealing with the kern, the circle of inertia, the ellipse of inertia, graphical computations of moments and products of inertia, and conjugate axes of inertia. Certain terms are defined in such a way that the method is extended to include the effect of deformations due to longitudinal stress and to shear in ribbed members, and to include trussed members.

The method has application in the fields both of design and of research.

Construction joints in concrete.—Bonding new concrete to old, N. Davey (*[Gt. Brit.] Dept. Sci. and Indus. Research, Bldg. Research, Spec. Rpt. 16*

(1930), pp. VI+74, pls. 10, figs. 6).—The results of experiments on the making of construction joints in concrete and their subsequent behavior are reported.

Part 1 of the report deals with the details of the experimental procedure, and part 2 deals with the evils attending the improper construction of joints. Part 3 discusses the factors reducing the efficiency of bond at construction joints, among which are segregation and the formation of laitance, scum, dirt, and clay arising from the use of unclean materials, and oil and grease deposited from the mixing plant and tools.

Part 4 is concerned with the preparation of the surface of the old concrete for bonding on the new concrete. It is concluded that the best method of treating the old surface of matured concrete resulted from bushhammering and wire-brushing. Immature concrete did not give such good results by this treatment. The use of certain proprietary solutions for treating the surface of concrete was found to be advantageous. The bond strength was generally higher with less matured concrete than with thoroughly matured concrete. Washing the surface of cement concrete with dilute hydrochloric acid to produce a key for the new concrete did not produce very good results.

The method of application of the new concrete to the prepared surface of the old concrete is dealt with in part 5. It was found that to insure a good bond a mixture must be used which is sufficiently plastic to enter the interstices of the surface of the old concrete. The durability of construction joints is discussed in part 6.

Part 7 is concerned with the bonding of different types of cement. There appeared to be no objection to bonding on new concrete prepared with a different type of cement. The adhesion of normal Portland cement concrete to aluminous cement concrete was only approximately 80 per cent of the adhesion of normal Portland cement concrete to the same material. The bond of rapid-hardening Portland cement concrete to normal Portland cement concrete appeared to be slightly better than the bond of rapid-hardening Portland cement concrete to the same material.

The estimation of free calcium hydroxide in set cements.—A calorimetric method, G. E. Bessey (*[Gt. Brit.] Dept. Sci. and Indus. Research, Bldg. Research, Tech. Paper 9 (1930), pp. IV+25, figs. 5*).—This paper deals with the development and application of a new calorimetric method for the estimation of free calcium hydroxide in fresh and set cements. The method consists of two simple determinations of heat of hydration of samples ignited at two different temperatures. Tests showed that the method gives satisfactory, reproducible, and reasonably accurate results with hydrated Portland cement.

Influences affecting the life of fence wire and methods for preventing its corrosion, W. C. Pruett et al. (*Bul. Amer. Ry. Engin. Assoc., 32 (1930), No. 330, pp. 172–174*).—The results of experiments are briefly summarized which indicate that zinc is the most suitable protective coating for wire, the protection afforded being determined by the amount of zinc coating per square foot of surface treated. The galvanizing on barbs of barbed wire and the stays and wraps of woven wire is usually the first to fail.

The use of corrosion-resisting steel for the base in wire is almost equal to, if not better than, a good coating of galvanizing. The annealing treatment produces an iron-zinc alloy which has proven by tests to provide a longer life to coating, with the resultant longer period of galvanizing protection to the steel base against ordinary corrosion. The damaging effect of the zinc coating on wire resulting from the burning of vegetation under and about the wire was found to be very pronounced.

Production of gasoline and lubricants by hydrogenation, R. T. Haslam and W. C. Bauer (*S. A. E. [Soc. Automotive Engin.] Jour., 28 (1931), No. 3,*

pp. 307–314, figs. 10).—A brief description of the hydrogenation process and its three characteristic reactions, purification, stabilization, and homogenization, is followed by a discussion of the possibilities of applying the process to the production of engine fuel and lubricating oil. The possibilities offered by the process of reforming the molecular structure of petroleum hydrocarbons along directed lines to obtain products of the so-called paraffin or naphthene type are stressed. Data are presented on the actual properties and performance characteristics of hydrogenated gasolines and lubricating oils.

From the test results the conclusion is drawn that hydrogenated lubricating oils made from common crudes are superior to the best natural lubricants now available, and that high-grade naphthenic gasolines and blending stocks can be produced from relatively low-grade gas oils. It is further concluded that the ultimate results of the process will enable the engineer to design engines that are capable of operation at greater compressions, higher speeds, and higher temperatures.

Detonation characteristics of some paraffin hydrocarbons, W. G. Lovell, J. M. Campbell, and T. A. Boyd (*Indus. and Engin. Chem., 23 (1931), No. 1, pp. 26–29, fig. 1*).—Experiments are reported in which the relative knock ratings of 27 paraffin hydrocarbons were determined in admixture with a commercial gasoline in an engine. These knock ratings are expressed on a common molecular basis using the antiknock effect of aniline as the standard of comparison.

On this basis definite relationships between molecular structure and a tendency to knock were found. These are summarized in the statement that in a homologous series the tendency to knock increases with the increasing length of the carbon chain, while in an isomeric series the tendency to knock usually decreases as the number of side chains is increased. The successive introduction of methyl groups into a carbon chain of given length also decreases the tendency to knock, and by substantially a constant increment per methyl group added.

Following combustion in the gasoline engine by chemical means, L. Withrow, W. G. Lovell, and T. A. Boyd (*Indus. and Engin. Chem., 22 (1930), No. 9, pp. 945–951, figs. 11*).—Investigations are reported in which measurements were made of the oxygen concentration in gases withdrawn from the cylinder of a gasoline engine with a new and improved sampling valve. This valve was located at different places in the combustion chamber and opened at different times during the combustion of the charge.

Under the conditions defined the combustion process in the gasoline engine consists of a narrow combustion wave which proceeds from the spark plug through the combustion chamber at a finite rate. The combustion zone travels at a greater rate and follows a different type of acceleration curve through the middle portion of the combustion chamber than along the side walls. Over the range investigated the average speed of the combustion zone increases with the engine speed. The progress of the combustion zone is unaffected by a change in spark timing or by the addition of sufficient lead tetraethyl to the fuel to stop detonation until after it has traveled the greater portion of the distance across the combustion chamber. The disturbance which is known as the knock or detonation is confined to that part of the charge which burns last.

Garden tractors on Long Island, A. A. Stone (*Farmingdale, N. Y.: State Inst. Appl. Agr., 1929, pp. 24, figs. 16*).—The results of a survey of the use of garden tractors in the truck garden industry of Long Island are presented, together with a historical statement relating to the history of farm tractor development and especially of the garden type of tractor.

The need of improved machinery for terrace construction and farming terraced land, C. E. Ramser (*Agr. Engin., 12 (1931), No. 2, pp. 39–42, figs. 10*).—

In a contribution from the U. S. D. A. Bureau of Public Roads information is presented on implements and machinery for terracing and for farming terraces, on the use of tractors over terraces, and on planting over terraces.

In experiments relating to the operation of general-purpose tractors in terraced fields, particularly in the cultivation of crops, the two outstanding criticisms were found to be lack of self-stabilization, resulting in a tendency to creep when working on the side of a terrace, and lack of flexibility in both the longitudinal and lateral planes of the cultivator.

In experiments on planting over terraces it was found that, except on very wide terraces, wide drills are not adapted for use on terraced land, particularly where the terraces are crossed at any angle and on the steeper slopes. Where the practice of crossing terraces is followed, much better results are accomplished when the drilling is done at about right angles to the terrace.

Lack of flexibility is also a criticism of cotton and corn planters in farming across terraces.

In the use of harvesting machinery it was found that a 20-ft. combine will work successfully over terraces from 30 to 40 ft. wide and on slopes varying from level to 4 per cent.

Types of terracing machinery used in Texas, H. P. SMITH (*Agr. Engin., 12 (1931), No. 2, pp. 43, 44, figs. 4*).—In a contribution from the Texas Experiment Station a brief description is given of the types of machinery used for terracing in Texas. In tests of the efficiency of terracing machines it was found that the efficiency is directly proportional to the ability of the blade to penetrate the soil and to its scouring qualities.

Developing machinery for beet production, E. M. MERVINE (*Agr. Engin., 12 (1931), No. 2, pp. 49–53, figs. 9*).—In a contribution from the U. S. D. A. Bureau of Public Roads the results of preliminary investigations on the development of machinery for sugar beet production are presented. No conclusions are drawn.

Observations on trials of a new type of small grain harvester, A. J. SCHWANTES (*Agr. Engin., 12 (1931), No. 2, pp. 59–61, figs. 4*).—Results of tests conducted at the Minnesota Experiment Station with a new type of small grain harvester are reported. This machine is similar to the grain binder except that a circular tank about 7 ft. in diameter and about 6 ft. high replaces the binder head. It has a 12-ft. cutter bar which is adjustable for height. No conclusions are drawn.

Separating efficiency of prairie type combines on cross grades, E. G. MCKIBBEN (*Agr. Engin., 12 (1931), No. 2, pp. 63, 64, figs. 4*).—The results of studies conducted at the Pennsylvania Experiment Station are reported. These indicate the need of additional investigation of the effect of cross grades on the separating efficiency in harvesting grain with heavy yields of straw, and of the effect of cross grades on losses at other points such as the sides of grain pans and conveyors. Other factors needing investigation are the development of a practical automatic leveling device for the combine, the reduction of the losses resulting from side grades, and the proper ratio between the threshing capacity of the cylinder and the straw-handling capacity of the separator for heavy yields of straw.

AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY

[Additional papers presented at the twentieth annual meeting of the American Farm Economic Association] (*Jour. Farm Econ., 12 (1930), No. 3, pp. 359–426, figs. 16*).—Included are the following papers and discussions thereon presented at the meeting previously referred to (E. S. R., 63, p. 383):

A State Program of Agricultural Development, by G. F. Warren (pp. 359–366); Organization of Farm Management and Outlook Information for Effective Extension Use, by H. Keller, jr. (pp. 367–371); The Organization of Farm Management and Outlook Information for Effective Extension Use, by W. F. Knowles (pp. 372–383); Interpretation of Farm Efficiency Factors, by J. A. Hopkins, jr. (pp. 384–404); and Development of Commercial Farm Management Service, by H. C. M. Case (pp. 405–426).

Research in local and national outlook work, H. R. Tolley (*Jour. Farm Econ., 12 (1930), No. 4, pp. 588–594*).—This is a paper read at the fourth annual meeting of the Western Farm Economics Association at Logan, Utah, June 10, 1930.

The agricultural depression and the technical revolution in farming, G. A. Studensky, trans. by L. Volin (*Jour. Farm Econ., 12 (1930), No. 4, pp. 552–572*).—The author's hypothesis concerning the nature of the present agricultural depression is that (1) it is not a continuation of the crisis of 1920 and is not strictly speaking a depression; (2) it is the beginning of a profound agricultural crisis which will cause considerable shifts and changes in the world agriculture, particularly in grain farming; (3) the crisis was inevitable and unavoidable and the deflation or crisis of 1920 did not cause it, although it probably accelerated and accentuated it; and (4) the immense technical revolution brought about by the internal combustion engine is at the bottom of the approaching crisis.

The relationship of business activity to agriculture, E. Graue (*Jour. Polit. Econ., 38 (1930), No. 4, pp. 472–478, fig. 1*).—A study is made of the relation between the ratio of food prices to prices of manufactured commodities and bank debits outside of New York City. The data indicate that with the exception of the years 1895–96 and 1908–9 the purchasing power of food prices in terms of manufactured commodities has usually moved in a manner directly opposite to that of the index of business activity.

The author concludes that "the contention that the cyclical position of urban industry correlates positively with that of agriculture does not seem to hold. . . . Nor does it seem possible to support the theory that reduced activity in urban enterprise can be traced to the loss of purchasing power suffered by the farm industry."

Middlemen's margins as a cause of the agricultural depression, H. I. Richards (*Jour. Farm Econ., 12 (1930), No. 4, pp. 523–551, figs. 4*).—Analysis is made of the margins between farm prices, wholesale prices, and city retail prices of a number of farm products. The conclusion is reached that "the evidence presented does not warrant the conclusion that relatively high costs of distribution have been the 'most serious single factor in causing the agricultural depression,' or even that they have been a very important factor."

The assessment system of Minnesota in its relation to equality of taxation, G. B. Clarke (*Jour. Farm Econ., 12 (1930), No. 4, pp. 573–587, fig. 1*).—This study is confined chiefly to data from 577 farms in the southeastern part of Minnesota, the oldest settled and most densely populated section of the State and the most important dairy section. The average percentage that assessed value was of sale value was 92.3, increasing from 77 per cent for the farms with sale value over $20,000 to 101.6 per cent for those with sale value of less than $5,000. It was 85 per cent for farms over 200 acres, 97.3 per cent for those from 160 to 200 acres, 91.9 per cent for those from 120 to 160 acres, 92.4 per cent for those from 80 to 120 acres, 92.5 per cent for those from 40 to 80 acres, and 85.5 per cent for those of less than 40 acres. It increased from 67.1 per cent for farms valued at over $200 per acre to 124.6 per cent for those valued at $50 to $75 per acre and was 110.9 per cent for those valued at less

than $50. There were also inequalities in each group between individuals. In 1914 and 1915 unplatted land was assessed from 81.1 to 92.6 per cent of its value in the 6 type-of-farming districts of the State, as compared with from 77.9 to 86.4 per cent for platted land. In 1926 and 1927 the ranges were 67.5 to 85.8 and 61 to 78.4 per cent, respectively.

The rural tax problem in Pennsylvania, F. P. Weaver (*Pennsylvania Sta. Bul. 263 (1931), pp. 35, figs. 6*).—The tax burden on agriculture and other groups of enterprises and the reasons for the inequalities, the problems of rural public school support and of maintaining township roads, the effects of the falling land values and of good roads on rates of assessment, and the cost of tax collections are discussed. Suggestions are made for improving the tax system of the State.

Federal, State, and local taxes in 1924 and 1925 required 38 per cent of the net income of agriculture and mining corporations in the State, as compared with from 13 to 27 per cent for other groups of enterprises. Much of the excessive taxation borne by farmers is due to the fact that real estate carries too large a share of the total tax burden. Under the present system the burden on rural school districts is very uneven and excessive. While the farmers furnish only about 17 per cent of the traffic on dirt roads, they are paying 36 per cent of the costs of maintaining township roads. The ratio of assessments to selling prices of properties was found to vary from about 10 to over 150 per cent in a number of counties. Usually assessment rates in cities were lower than in townships. The costs of collecting taxes varied from less than 0.5 per cent in counties where collections were made by the county treasurer to over 5 per cent in some cases where collections were made by local collectors on a fee basis.

Remedies suggested are shifting more of the costs of schools and of township roads from rural real estate to other sources of income, abolishment of the fee system of local tax collection, more equable assessments through supervision by trained men and better equalization, and the establishment of a flat rate individual income tax and a tax on the net earnings of corporations and partnerships not paying taxes on capital stock or gross receipts.

Children working on farms in certain sections of the western slope of Colorado, C. E. Gibbons and H. M. Bell (*Natl. Child Labor Com. Pub. 327 (1925), pp. 112, figs. 2*).—This is the first of a series of four reports on children working on farms in different sections of Colorado. It is based on data regarding 330 families with 276 children 5 years of age or under, 838 children from 6 to 15 years of age, and 258 children 16 years of age or over. The data were obtained in Mesa, Montrose, and Delta Counties between June 20 and November 20, 1924. The types and amount of work done by children; the working conditions; data as to age, nationality, education, etc., of parents; tenure conditions of families; living conditions; food; community and recreational interests; school attendance and grade standing; etc., are discussed.

Children working in the sugar beet fields of certain districts of the South Platte Valley, Colorado, S. A. Brown, R. O. Sargent, and C. B. Armentrout (*Natl. Child Labor Com. Pub. 333 (1926), pp. 167, figs. 15*).—This is the second of the series noted above and is based on data regarding 434 families with 1,081 child workers under 16 years of age. The data were obtained in Logan, Morgan, and Weld Counties during the summer and fall of 1924 and are discussed along the same lines as in the previous report.

Children working on farms in certain sections of northern Colorado, B. F. Coen, W. E. Skinner, and D. Leach (*Colo. Agr. Col. Bul., ser. 27 (1926), No. 2, pp. 160, figs. 16*).—This is the third report of the series noted above and was prepared in cooperation with the National Child Labor Committee. The data, which were gathered in the summer, fall, and winter of 1924 by survey

regarding 512 families with 1,095 working children in Boulder, Weld, and Larimer Counties, are discussed along the same general lines as in the previous reports.

Child labor in agriculture and farm life in the Arkansas Valley of Colorado, B. H. MAUTNER, W. L. ABBOTT, ET AL. (*Natl. Child Labor Com. Pub. 359* (*1929*), *pp. 158, figs. 7*).—This is the fourth report of the series noted above. The data were gathered in the summer, fall, and winter of 1924 regarding 329 families with 659 working children in Otero and Crowley Counties. The general plan of analysis is the same as in the previous reports.

The budget method of improving farm organization and management, W. G. FINN and Z. L. GALLOWAY (*Kentucky Sta. Bul. 312* (*1930*), *pp. 601–628, figs. 5*).—The advantages of budgeting and when and how to prepare a budget are discussed. The results of budgeting, 1924–1929, on organization and the returns from a 100-acre and a 200-acre farm are shown.

Land survey of the town of Durham, New Hampshire, C. E. WALKER (*New Hampshire Sta. Bul. 255* (*1931*), *pp. 23, figs. 5*).—This is a survey made to determine the types of land on the basis of use in the town. It was made by separating the town into blocks with definite boundaries and running strips back and forth across each block. Distances were paced. The cost of the survey was $1,090, and 15,324 acres were included.

Economic aspects of land settlement in the cut-over region of the Great Lakes States, W. A. HARTMAN and J. D. BLACK (*U. S. Dept. Agr. Circ. 160* (*1931*), *pp. 86, figs. 44*).—This bulletin is based on a comprehensive survey in 1919 and 1920 of land settlement conditions in 47 settlement areas in the cut-over region of Michigan, Wisconsin, and Minnesota, made by the U. S. D. A. Bureau of Agricultural Economics in cooperation with the State experiment stations of Minnesota and Wisconsin and the department of geography of the University of Michigan (E. S. R., 52, p. 893), and on a repetition of this survey in part in 33 of the settlement areas made in 1928 in cooperation with the experiment stations of the three States and the Wisconsin State Department of Agriculture.

The physical aspects, agricultural development, forest and crop production, and social and business aspects of the region are described. The credit problems, progress settlers may expect to make, farm turnover since 1920 in the 33 resurveyed settlement areas, and the general outlook for land settlement in undeveloped regions are discussed.

Some research problems in farm finance in the Southwest, B. M. GILE (*Southwest. Polit. and Social Sci. Quart., 10* (*1930*), *No. 4, pp. 409–415*).—This is a brief discussion of the status and problems of farm credit, with suggestions as to research necessary in their solution.

Credit problems of Oklahoma cotton farmers, A. N. MOORE and J. T. SANDERS (*Oklahoma Sta. Bul. 198* (*1930*), *pp. 61, figs. 3*).—This bulletin brings together the results of several investigations made in cooperation with the Bureau of Agricultural Economics, U. S. D. A., special attention being given to surveys in 1925 of the credit operations of 74 owner and 89 tenant cotton growers in Jackson County and 42 owner and 165 tenant operators in Pittsburg County, and in 1926 of the credit situation of 32 owners and 47 tenants in Garvin County. The conditions in the districts as regards tenure; number, size, and value of farms; race of operators; type of farming; and value of cotton production are described. The volume and source and carry-over from year to year of seasonal credit and the security of and reasons for the need of such credit; the relation of number of years of farming life to the use of credit, and the relation of the credit conditions of owners and tenants are discussed. The costs of short-term credit—cash and merchant—in the three districts and

to owners and tenants are analyzed. The cost, term, and sources of farm-mortgage loans and other credit problems are also discussed. Some suggestions are made regarding the means by which individual growers can reduce their need for credit and obtain credit at lower cost.

Seasonal credit was used by 65 per cent of the owners and 86 per cent of the tenants, and farm-mortgage credit by two-thirds of the owners interviewed. Owners used an average of $610 of seasonal credit and tenants $390. Over 25 per cent of such credit was obtained from local stores. The average cost of seasonal credit was 16.4 per cent, that on loans from banks and individuals being 11.3 per cent, and that from stores 32.5 per cent The rate on farm-mortgage loans averaged 7 per cent. In the poorest of the three districts (Pittsburg County) 86 per cent of the farmers interviewed used seasonal credit, the average amount being $398, of which 50 per cent was store credit, which frequently cost about 80 per cent. The farmers who earned the most spent and saved the most and were usually the least dependent on seasonal credit. Those who had income from other sources than cotton and raised most of their feed and food supplies used short-term credit less frequently and in smaller amounts than did specialized cotton growers. Owner operators tended to become independent of seasonal credit as they grew older and wealthier. Tenants, although their wealth had increased, became more dependent on seasonal credit, if anything, as they grew older. The general differences in seasonal credit costs between banks and merchants, between districts, and between owners and tenants were explained largely by the differences in risk and other expenses of the credit business.

Price stabilization under the Farm Board, R. B. Heflebower (*Jour. Farm Econ., 12 (1930), No. 4, pp. 595–610*).—This article examines "the meaning and theoretical assumptions of price stabilization as outlined in the Federal Agricultural Marketing Act and exemplified in the policies of the [Federal] Farm Board."

Index-numbers of prices of agricultural products and other price-indices of interest to the farmer (*Rome: Internatl. Inst. Agr., 1930, pp. XXIV+123*).—Part 1 (pp. 3–75) describes in detail the methodology in Germany, England and Wales, Argentina, Australia, Canada, Estonia, the United States, Finland, Hungary, Italy, Norway, New Zealand, the Netherlands, Poland, Sweden, Switzerland, and Yugoslavia in preparing index numbers of agricultural products. Part 2 (pp. 79–123) consists of tables of the index numbers in the several countries grouped for a series of years as far as possible from January, 1921, to December, 1929. The introduction briefly reviews the data, and the letter of transmittal describes the purposes, plans, and problems of the International Institute of Agriculture in conducting the study. There are both English and French editions.

The feed purchasing power of eggs, E. M. Funk (*Pennsylvania Sta. Bul. 262 (1931), pp. 15, figs. 5*).—Tables based on the records of 52,900 hens and pullets covering the period 1925–1929 are given showing the monthly distribution of egg production and feed consumption of flocks with an average annual production of 106, 154, and 173 eggs per hen. Using these data and prices received by producers for eggs as determined by the Pennsylvania Federal-State Crop Reporting Service, tables were calculated showing, by months, for 1910–1929 the purchasing power of the production of these hens as computed in pounds of a standard ration (200 lbs. of corn meal, 100 lbs. of wheat bran, 100 lbs. of wheat flour middlings, 100 lbs. of ground oats, and 100 lbs. of meat scrap as a mash, and 400 lbs. of corn, 200 lbs. of wheat, and 200 lbs. of oats as a scratch feed).

The monthly variations in feed consumption varied from 5.6 to 6.5 lbs. for the 106-egg flocks, from 5.7 to 6.8 for the 154-egg flocks, and from 6.2 to 7.5 lbs. for the 173-egg flocks. The 173-egg flocks consumed 5.64 lbs. per dozen eggs laid, and the 106-egg flocks 8.34 lbs. During the period 1910–1929 the egg production of a 106-egg hen would purchase from 88 to 132 lbs. of feed, that of a 154-egg hen from 132 to 202 lbs., and that of a 173-egg hen from 150 to 235 lbs. The purchasing power in March was double that in October or November. The average price received for eggs from high-producing flocks was higher than that from low-producing flocks, the difference being 2.28 cts. per dozen in 1920. Eliminating the period during and following the war, definite regular cycles of approximately 30 months were found to exist in the purchasing power of eggs.

Crops and Markets, **[April, 1931]** (*U. S. Dept. Agr., Crops and Markets, 8 (1931), No. 4, pp. 121–160, figs. 2*).—Included are tables, graphs, reports, notes, and summaries of the usual types, and tables with explanatory text showing intentions to plant different crops, March 1, 1931, and the sale prices of purebred beef cattle, dairy cattle, hogs, and sheep, 1929 and 1930.

Barley, E. W. Braun (*California Sta. Bul. 512 (1931), pp. 32, figs. 14*).—The trend and distribution of barley production, the disposition of the crop, and the exports from California, the trend in world production, the world competition in the United Kingdom, the price of export barley, the seasonal movement of barley prices, and the factors affecting such prices in San Francisco are discussed, and conclusions are drawn as to future prices of barley in California.

Rice farming in Arkansas, with financial results for 1927, O. J. Hall (*Arkansas Sta. Bul. 260 (1931), pp. 56, figs. 20*).—This study is based on schedules obtained in 1928 from 49 owners, 24 part owners, and 34 tenants for farms varying in size from 60 to over 1,000 acres. A general description of the soil, topography, climate, and population of the area, and of the size, utilization of land, investment, and capital requirements of the farms studied is included. The analysis includes arithmetic averages for all farms, by size and tenure of groups, of crop acres, interest charges, expenses by major items, net cash receipts, and farm labor income. Simple linear correlation is used to indicate the probable effects of certain major factors on returns. The relation of price per bushel and yield per acre to net cash return and farm labor income, and the per acre variations in total cost, cost of irrigation water, and cost of property investment are discussed.

The average property investment (95 farms) was $27,952, net cash receipts $4,392, and net returns to unpaid family labor and management $1,983. Over 96 per cent of the cash receipts was from rice. Approximately 90 per cent of the growers received from 75 cts. to $1 per bushel for rice. Yields per acre (105 farms) varied from 23.6 to 83.3 bu., averaging 51.9 bu., and being from 41.8 to 61.7 bu. for the middle 50 per cent of the farms. The total cost of production (74 farms) averaged $38.77 per acre, that for the 20 farms with the lowest cost being $30.39, and that for the 20 farms with highest cost $53.79. The cost of water and cost of capital, the largest items, varied from $3.99 to $24.88 and from $3.89 to $27.23 per acre, respectively, for the 74 farms, averaging $6.66 and $6.10, respectively, for the 20 lowest cost farms and $17.05 and $16.93 for the 20 highest cost farms. There was a tendency for the net cash return to be less than average on farms with less than 167 acres in rice. Total costs per acre on an average became less with increase in rice acreage up to over 349 acres. The correlation analysis gave the following coefficients for different relations: Acreage in farms and net cash returns +0.43, acreage in rice and net cash returns +0.60, acreage in rice and farm labor income +0.28, price per bushel and net cash receipts +0.25, yield per acre and net cash returns +0.53, yield per acre and farm labor

income +0.44, yield per acre and cost per acre +0.17, and yield per acre and cost per bushel —0.62.

The changing world wheat situation: A statistical appraisal in terms of averages, trends, and fluctuations, H. WORKING ET AL. (*Wheat Studies, Food Research Inst. [Stanford Univ.], 6 (1930), No. 10, pp. [1]+421–457, pl. 1, figs. 17*).—Maps and charts show the production, imports, exports, and domestic utilization of wheat in the principal countries and groups of countries for the crop years 1922–23 to 1928–29, inclusive. The trends of production and consumption in the several countries and the annual fluctuations in the international situation are discussed.

The study shows that "the changing surpluses from Canada, Argentina, Australia, and from some minor exporters are forced on the international market almost without regard to price. Half of the usually large United States surplus may be exported or withheld, depending chiefly on the export price. Indian and Danubian exports also depend on price. Among the major importers, only Great Britain, Germany (prior to the war), the Netherlands, and perhaps Belgium appear commonly to adjust reserves so that fluctuations in the size of their own crops and part of the fluctuations in international supplies are absorbed. Italy, France, and Spain make no measurable adjustment either of domestic consumption or of year-end stocks to the international supply situation, but absorb part of the fluctuations in their domestic crops."

The great increase in the percentage of the world's wheat supplies coming from Canada, Argentina, and Australia—countries that tend to force their entire exportable surplus on the world market and two of them countries in which yields vary greatly, the inability of Germany to assist in stabilization, import duties and trade regulations, etc., since the war favor wider fluctuations in wheat prices than occurred during the 15 years prior to the war. As the result of the unusual combination of circumstances, the autumn of 1930 finds the ability and disposition to withhold or to accumulate surplus stocks, essential to the prevention of abnormal prices, weakened or absent to an extraordinary degree. The need of more adequate information on stocks of wheat and on the different forms of utilization is brought out.

The world position of wheat, A. J. PERKINS (*Jour. Dept. Agr. So. Aust., 34 (1930), No. 5, pp. 454–466*).—Data are given showing the increase in wheat acreage, production, and consumption in Australia; the acreage, production, exports, imports, and consumption of other countries or areas; and the apparent per capita consumption per year of other cereals in typical countries.

Bulk and sack handling of grain in the Pacific Coast States, E. N. BATES, G. P. BODNAR, and E. J. STIRNIMAN (*U. S. Dept. Agr. Circ. 161 (1931), pp. 28, figs. 19*).—The advantages and savings in costs of handling grain in bulk over sack handling and the advantage of sack handling under certain conditions are discussed.

Based on data on costs obtained on approximately 45,000 acres of grain in California in 1923 and 1924, the estimated saving in cost by handling in bulk on farms, 1923–1927, varied from 10.78 to 12.02 cts. per bushel for barley and from 12.51 to 14.52 cts. for wheat. Wheat-inspection records at Portland and Astoria, Oreg., for the crop years 1920–21 to 1927–28, inclusive, showed that 41.4 per cent of the sacked grain was smutty. The possible saving per bushel in handling wheat for export at these points by the bulk method was found to be 18.8 cts. for smutty grain and 16.4 cts. for smut-free grain.

Bulk handling grain from the hillside type combine, H. BERESFORD and E. N. HUMPHREY (*Idaho Sta. Bul. 175 (1930), pp. 19, figs. 21*).—The equipment requirements and costs of hauling grain direct from the combine to warehouse

and of hauling with intermediate field bin storage and with farm storage are discussed. Plans for field bins of different types are included.

The operating cost of hauling wheat and barley direct from combine to warehouse (average distance 5 miles) was 3.53 cts. per bushel, and that from intermediate field bins (average haul 4.9 miles) 3.65 cts. per bushel. The costs per ton-mile were 4.07 and 1.89 cts., respectively.

An economic study of the small-fruit industry in Oregon, G. L. Sulerud and M. N. Nelson (*Oregon Sta. Bul. 274 (1931), pp. 95, figs. 27*).—Tables and charts are included and discussed showing the geographic distribution and national and regional trends in acreage and production of small fruits in the United States; the geographic location and importance of the industry, the trends in bearing and nonbearing acreage, by districts and counties, and the varieties and yields in Oregon; the trends, national and of the leading States, in the canned fruit pack of different kinds of berries; the foreign exports of canned berries; the trends in the volume of cold-pack berries in Oregon and Washington and in other areas; and the extent of the shipments of dried and fresh small fruits from Oregon.

The comparative utilization of the berry tonnage in the Pacific Northwest and Oregon, 1925–1929; the prices of Oregon berries, 1910–1929; and the comparative opening prices of canned berries and other fruits, 1925–1929, are discussed. Conclusions are drawn as to the situation and outlook for the different berries in Oregon.

Economic factors affecting the beef-cattle industry of Virginia, C. A. Burmeister, H. M. Conway, and A. P. Brodell (*U. S. Dept. Agr., Tech. Bul. 237 (1931), pp. 66, figs. 8*).—This bulletin summarizes the material obtained in several economic studies conducted in cooperation with the Virginia Experiment Station. It presents an analysis of the production and marketing methods of beef cattle raisers in Virginia, and makes suggestions as to possible readjustments with a view to placing the industry on a more profitable basis. The information was obtained through interviews with cattle producers, local buyers and shippers, slaughterers and meat distributors, and representatives of railroads and market agencies.

The changes in the beef cattle industry of the United States and the export trade in cattle and beef, the distribution of beef cattle in Virginia, the Virginia methods of finishing steers and selling cattle, contract buying in the State, market outlets, transportation service, market destinations and seasonal movements of Virginia cattle, marketing costs of competing cattle, cattle prices at Jersey City, N. J., and Chicago, Ill., market grades of cattle, competition for Virginia beef in New York, the problem of dark-colored beef, trade opinion of Virginia cattle, and the possibilities of increasing returns on Virginia steers by improving the grade are discussed.

A detailed analysis is made of the production records of 70 droves, totaling 4,203 head, finished by grazing in southwest Virginia from August to November, 1924; of 16 droves, totaling 679 head, finished by feeding in the Shenandoah Valley and north Virginia during the winter of 1924–25; and of approximately 1,110 steers from southwest Virginia in 1926. Tables are included and discussed showing the results of different methods of wintering and fattening steers and the marketing records—weight, shrinkage, fill, cost, etc., and slaughter information for the shipments from the different sections.

Factors affecting the physical and economic cost of butterfat production in Pine County, Minnesota, G. A. Pond and M. Ezekiel (*Minnesota Sta. Bul. 270 (1930), pp. 37, figs. 4*).—Detailed cost account records were kept under the supervision of a field man on 28 dairy herds in 1925, 24 in 1926, and 25 in 1927. Tables are included showing for each herd on a per cow basis the total digestible

nutrients, except pasture; nutritive ratio of feed; proportion of total digestible nutrients in dry roughage, in succulent roughage, and fed on pasture from June to October, inclusive; the butterfat test; production of butterfat and production of milk; average age of cows; proportion heifers in first lactation period were of total cows; proportion of cows freshening, September to December; and quality of management. The influences of each of the individual factors on butterfat production and the economic effects of time of freshening, fat test of milk, protein in the ration, hay and silage in the ration, and herd management are discussed.

Correlation analysis was made of the relations of the following factors to average milk production per cow per year ($\overline{X}_1$) : $\overline{X}_2$, total digestible nutrients in pounds; $\overline{X}_3$, nutritive ratio; $\overline{X}_4$, digestible nutrients in succulent roughage as percentage of total digestible nutrients; $\overline{X}_5$, digestible nutrients fed while on pasturage as a percentage of total digestible nutrients; $\overline{X}_6$, fat test in percentage of fat; $\overline{X}_7$, average age of cows; $\overline{X}_8$, number of cows in herd freshening, September to December, inclusive, as a percentage of total number of cows; $\overline{X}_9$, year of record, coded to represent approximate differences in quality of pasturage each of the three years; and $\overline{X}_{10}$, number of heifers in their first lactation period as a percentage of total number of cows in the herd. All factors were stated as logarithms to put the relations on a relative rather than on an absolute basis.

The correlation with all the factors included showed that variables $\overline{X}_5$, $\overline{X}_9$, and $\overline{X}_{10}$ had no significant effect on production, and a new factor, $\overline{X}_{11}$, computed by subtracting the sum of $\overline{X}_5$ and $\overline{X}_4$ from 100, was introduced to measure the proportion of total nutrients fed as concentrates. Eliminating $\overline{X}_5$, $\overline{X}_9$, and $\overline{X}_{10}$ and using $\overline{X}_{11}$, a linear multiple correlation of R=0.857 was obtained after adjusting to eliminate the tendency for the computed correlation to be too high with 7 variables and only 77 observations. The apparent curvilinear correlation was P=0.864 after adjusting for the number of variables and constants represented in the functional regression equation. Only the factors $\overline{X}_2$, $\overline{X}_3$, $\overline{X}_4$, $\overline{X}_6$, and $\overline{X}_8$ appeared to be significant.

A third multiple correlation using these 5 variables gave R=0.851 after adjusting for the number of variables. The percentages determination for the factors were for $\overline{X}_6$, fat test, 40.1; $\overline{X}_8$, fall freshening, 6.4; $\overline{X}_3$, nutritive ratio, 15; $\overline{X}_2$, total digestible nutrient, 11.6; and $\overline{X}_4$, proportion of silage, −0.7. The equation (as corrected by author) for estimating milk production from the 5 factors is

$$\log \overline{X}_1 = 3.3924 + 0.4575 \ (\log \overline{X}_2) - 0.7584 \ (\log \overline{X}_3) + 0.0764 \ (\log \overline{X}_4) - 1.2435 \ (\log \overline{X}_6) + 0.0408 \ (\log \overline{X}_8).$$

As a final verification the following factors were correlated with production in terms of pounds of butterfat, (X_1) : X_2, total digestible nutrients; X_3, nutritive ratio; X_4, proportion of silage; X_6, fat test; X_8, fall freshening; and X_{11}, quality of management. This gave R=0.87. The determination coefficients of milk production were X_2, total digestible nutrients, 3.2 per cent; X_3, nutritive ratio, 5.3; X_4, proportion of silage, 0.4; X_6, fat test, 29.9; X_8, fall freshening, 2.9; and X_{11}, quality of management, 44.2 per cent, total 85.9 per cent. The coefficients of butterfat production were 5.8, 12.2, 0.3, −0.6, 3.9, and 51.1 per cent, respectively, total 77.7 per cent. Omitting the unimportant factor, X_4,

proportion of silage, the equation (as corrected by author) for estimating pounds of butterfat production is

$$\log X_1 = 1.9953 + 0.1814\ (\log X_2) - 0.3195\ (\log X_4) + 0.0664\ (\log X_8) + 0.01783\ (\log X_9) - 0.0525\ (X_{12}).$$

This study was made in cooperation with the U. S. D. A. Bureau of Agricultural Economics.

A statistical study of milk production for the New York market, M. P. Catherwood (*New York Cornell Sta. Bul. 518 (1931), pp. 126, figs. 40*).—This bulletin reports the results of a study made in cooperation with the New York Central Railroad and is based on records obtained from 1,025 New York and Pennsylvania farms for the year ended May 30, 1928. Records giving detailed information concerning the dairy, other livestock, and crops were obtained from 250 farms in the hay and general-farming regions and from 775 in counties where relatively large amounts of milk were produced per farm. A complete record of the milk sold by months was obtained from 641 of the 775 dairy farms. The elevation, climate, and soils of the area and counties are described, and the differences between the counties and regions in the utilization of land, crop acreages and yields, labor supply, livestock, cows and heifers per farm, season of freshening, feeding and milk production, sources and utilization of hay, utilization of milk, and breeds of cows are discussed. Tables are included and discussed showing for the farms grouped according to kind of milk and purpose for which milk was sold, the acres in farm, acres farmed, utilization of land, number of cows and heifers, daily milk production, amounts of different kinds of feed fed, milk production per cow, and the November–June ratio of milk sold.

Analysis is made of (1) the relation to season of milk production of time of freshening, percentage of milk sold in November, and the percentage of land in pasture and in permanent pasture and the acreage of pasture per animal unit on the 641 dairy farms, the 450 grade B milk farms, and the 70 grade A milk farms; (2) the relation of silage, practice of allowing bull to run in pasture, elevation of land, mileage of dirt roads, heifers per cow, percentage of cows purchased, production per cow, and milk market to season of milk production; and (3) the factors influencing production per cow. The probable trends in milk production and the future possibilities in the New York milk shed area are discussed. The schedule used in the study is included.

The demand for fluid milk and cream for the New York market has increased at an average of about 5 per cent per annum since 1885, and it is estimated that the requirements will be at least 30 per cent greater in 1940 than in 1930. The New York market at present is taking practically all of the approved milk during November and a large percentage of such milk during the other months. If the New York milk shed is to supply the increasing demand, an increase in the production of approved milk will be necessary, although part of the increased demand can be supplied by a shift in seasonal production. The present milk shed has a great potential capacity for increased production for the New York market, and the chief problem is that of price, i. e., the price of milk as related to other prices, and the seasonal adjustment of milk prices. The increased demand for the next two or three years is likely to be supplied by an increase in the number of cows due to the large number of heifers raised in recent years. The probable low milk prices in 1931 and 1932, however, are likely to result in a later shortage of milk due to the resulting decrease in the number of heifers raised.

World production and international trade in dairy products [trans. title], K. Ritter (*Ber. Landw. Reichsmin. Ernähr. u. Landw.* [*Germany*], *n. ser., Spec. No. 22 (1930), pp. [V]+301*).—The production and foreign trade of the various

countries of the world and the international trade in general in dairy products are discussed.

The St. Lawrence navigation and power project: A rejoinder, L. R. Thomson (*Jour. Polit. Econ., 38 (1930), No. 4, pp. 479–482*).—This is a reply to the article previously noted (E. S. R., 63, p. 783).

The relation of the flow of population to the problem of rural and urban economic inequality, R. M. Rutledge (*Jour. Farm Econ., 12 (1930), No. 3, pp. 427–439*).—This paper, read at the Southwestern Division of the American Association for the Advancement of Science, Tucson, Ariz., April 22, 1930, is based upon a 3-year study of rural credit in Cache County, Utah.

The economic and social aspects of mobility of Oklahoma farmers, J. T. Sanders (*Oklahoma Sta. Bul. 195 (1929), pp. 71, figs. 3*).—This study, made in cooperation with the U. S. D. A. Bureau of Agricultural Economics, is based largely on information obtained from farmers by direct interviews, the number varying for different items, and on data obtained by the Federal Bureau of the Census. The extent of, and changes in, farm mobility, the time and cost of moving, magnitude of moving as shown by property change and valuation, and the motives for moving are discussed. Analysis is made of the relations between moving and size of farm, financial progress of farmers, returns on investments of landlords, amount and cost of credit, educational, social, and family life, family expenditures, reading, and membership in organizations. In the several tables the farmers are grouped principally by crop-reporting districts, counties, and crop areas of the State, tenure status, or number of years of earning life.

In 1924 about one-half of all tenants and one-third of all farmers in Oklahoma were on new farms, indicating that probably one-fourth of all farmers had moved from one farm to another. It is estimated that 7,750,000 acres of farm land and 4,200,000 acres of crop land changed hands in 1924. In 13 counties more than 60 per cent of the tenants were on new farms. Probably 36.5 per cent of all farm children under 10 years of age and 31.4 per cent of the farm population over 10 years of age were involved in the shifts. The direct cost of moving is estimated at about $2,000,000 per year. Possibly one-half of the moving is of no social or economic advantage to the farmer moving, the landlord, or the State. The useless moving is estimated to have cost the farmers interviewed, in direct cost, 5.4 per cent of their present net wealth.

A close relationship was found between the investment of farmers in machinery and livestock and the amount of moving they did, the amount of moving in the various counties dropping 1 per cent for approximately each $30 increase in the average value of machinery and livestock per farm. Wealth accumulation and stability as regards moving were found to be closely associated. In nearly all cases excessive movers had a markedly smaller amount of equipment capital and operated much less valuable farms than the more stable group.

There was some indication that the excessive movers depended more on one-crop farming than did the more stable farmers. Four surveys indicated that in most areas landlords of infrequent movers got one-third more return on their investment than did the landlords of frequent movers. Children of the less frequent movers averaged about 20 per cent more school progress per year than did those of more frequent movers. The more stable group of owners took 50 per cent more daily papers than did the least stable group, and the more stable group of tenants took about 25 per cent more dailies and 33 per cent more farm journals than did the more frequent movers.

A study of certain cash expenditures of Ohio farm families, G. Brinton (*Ohio Sta. Bul. 474 (1931), pp. 51*).—This study is based on data obtained from 70 families averaging 4.7 persons. The data were obtained by the survey and account-book methods, chiefly the former. Tables are included and

discussed showing by cash income groups the tenure status and age of farm operators, number of families spending in excess of cash incomes, and total expenditures by classes—food, clothing, operating expense, indications of comfort, and furniture, furnishings, and equipment; and by class of expenditure the average expenditures for families with cash incomes supplemented and unsupplemented from nonagricultural sources. Other tables show by groups based on amount of household expenditure the average expenditures for different items in the several expenditure classes.

The average cash income of the 70 families was $2,099.40 and the average household expenditure $1,107.52, divided as follows: Food 20.5 per cent, clothing 16.3, operating expense 12.7, indications of comfort 43.2, and furniture, furnishings, and equipment 7.3. The study showed that the operators between 40 and 59 years of age had the largest incomes and that size of family influenced household expenditures, the families of 5 persons not being able to live on $800 per annum and those of 5.4 persons requiring $1,200. The data bear out the Engel theory that family budgets in a society based on money economy show a tendency to hold food expenditures stable and to increase the proportions used for goods of present consumption or those classified as "indications of comfort," the average expenditures for food varying less than $100 for the $1,200 to $3,600 cash income groups, while expenditures for indications of comfort varied $478.57. The variation in unexpended surplus by $2,094.50 indicated that the competition expressed in Engle's laws was secondary to the primary relationship between present and future expenditures.

What the country women of the world are doing, I, II (*London: Liaison Com. Rural Women's Organ., 1929, [vol. 1], pp. [6]+130; 1930, vol. 2, pp. [2]+209*).—Volume 1 is the report of the first International Conference of Rural Women's Organizations, held at London, April 30 to May 3, 1929, and includes the proceedings of the conference, reports from national organizations by countries, lists of national associations and of journals published by rural women's associations, and the following papers, with discussions: Common Interests of Country Women (pp. 57–60) and The State and Rural Women's Organizations (p. 62), both by M. R. Watt; Extension Work in the United States, by Mrs. A. E. Brigden (pp. 62–66); International Associations of Rural Women, by E. H. Pratt (pp. 72–79); and The New World View Point of the Position of Country Women, by P. E. Warner (pp. 102–106). Lists with brief notes of some of the pioneer women workers in organizing the country women and some men who have helped in such work are also given.

Volume 2 is the report of the conference held at Vienna, Austria, May 28–30, 1930. It includes the proceedings, a directory of national country women's associations, lists of journals published by rural women's organizations, reports of country women's associations by countries, and short biographies of persons active in such organizations, together with the following papers: Scientific Method as Applied to Traditional Arts in Sweden, by M. Silverhjelm (pp. 105–108); The Great Inventory of Handicrafts in Finland, by T. Hainari (pp. 109, 110); The Influence of Folk Songs on the Family [trans. title], by G. Kotek (pp. 111, 112, Eng. abs. p. 112); Marketing Problems and the Country Woman [trans. title], by L. Kuessner-Gerhard (pp. 113–119, Eng. abs. pp. 120–124); Marketing Problems of Rural Women, by G. E. Frysinger (pp. 125–131); How to Improve Living Conditions of the Country Woman, by Mrs. Mrskosova (pp. 132–135); The Woman's Contribution to Agricultural Output as Affected by Agricultural Education, by E. H. Pratt (pp. 136–141); The Legal Position of the Country Woman [trans. title], by M. Keyserlingk (pp. 142–150, Eng. abs. pp. 151, 152); The Revival of Traditional Costumes in Switzerland, by S. Panchard de Bottens (pp. 153–158); Traditional Handi-

crafts, by Mrs. Pemberton (p. 159); The Woman's Place in Rural Economy [trans. title], by P. de Vuyst (pp. 160–163); Can Town and Country Women Work Together? by M. Michelet (pp. 164, 165); Why Country Women Organise as Non-Sectarian and Non-Political Bodies, by Mrs. Graham-Mylne (pp. 166, 167); Modernizing the Kitchen, by F. L. de N. Scott (pp. 168–172); and Kitchen Equipment, by S. G. Lind (pp. 173, 174).

AGRICULTURAL AND HOME ECONOMICS EDUCATION

Four-H club work in West Virginia, T. L. Harris (*West Virginia Sta. Bul. 241 (1931), pp. 36, figs. 2*).—Included are an analysis of the structure, functions, and influences of 341 clubs in 39 counties of the State; a study in one county of the boys of club age not club members; case studies of a county in which club work has made steady progress, of a county in which club work flourished, then declined, and is now at a standstill, and of an outstanding club; a statement of the greatest values and problems of club work as set forth in the replies of 39 county club supervisors to a questionnaire; an analysis of the effects of club experiences on present attitudes, character traits, and social behavior based on a study of 34 men and 36 women who had been club members; a statement of the attitude of a farm mother toward club work; and a discussion of the strong and weak points in the West Virginia 4-H club program.

FOODS—HUMAN NUTRITION

Baking vegetables electrically, VeN. W. Swartz (*Washington Col. Sta. Bul. 251 (1931), pp. 20, figs. 2*).—This bulletin summarizes, particularly for the housewife, the more important results of an investigation, some phases of which have been noted previously from a progress report (E. S. R., 64, p. 691).

Recommendations, based upon performance tests which are summarized in tabular form, are given concerning the selection of an electrical oven and oven utensils. General directions are outlined for the oven cooking of vegetables, with time-tables for cooking specific vegetables in amounts sufficient for four servings at different oven temperatures and in different utensils, one timetable serving for china, glass, enamel, or iron utensils and another for aluminum or stainless steel. On the basis of cost studies on vegetable cooking in the oven and on surface burners and on cooking entire meals in the oven or partly in the oven and partly on surface burners, recommendations are given for the most economical use of the electric oven for vegetable cooking. The final recommendations are as follows:

"Before purchase of an electric oven make certain that it is well insulated, that the door closes tightly, that the moisture vent is not automatic, and that there is a temperature regulator marked in degrees. If possible, buy the range on approval.

"In purchase of oven utensils remember that price and performance are not related. Some of the cheaper utensils are faster and more efficient than the more expensive ones, and with care can be just as durable. If utensils are going to be abused, heavy, unbreakable, and unbendable ware should be purchased. 'Waterless' cooking can be done as well in a cheap pan as in an expensive one if it has a well fitting cover.

"Many vegetables can be baked, with a very small quantity of water in a covered pan, in such a manner that when the vegetables are done there is no water left. Their flavor and texture are superior to boiled vegetables, and the loss of minerals and vitamins is far less than when cooked in much water and the water discarded.

"If the electric oven is to be used economically, it should be used to capacity, never for one food alone. Oven meals in which the meat, vegetables, and dessert are prepared at the same time are recommended. In addition to being economical of fuel, such meals are more easily prepared than are surface unit-cooked meals."

A study of the losses incurred in cooking and the factors affecting the palatability of the New Mexico pinto, bayo, and other varieties of beans (*New Mexico Sta. Rpt. 1930, pp. 74–78*).—This progress report (E. S. R., 63, p. 497) summarizes the findings in a study of the palatability of the New Mexico pinto bean cooked in various ways. Four methods were employed, involving the use of soft and hard water with and without soda added either to the soaking or cooking water.

The factor which was found to affect the palatability of the beans to the greatest extent was the hardness of the water. When soft water was used fairly satisfactory products were obtained with all of the methods, although the most suitable method appeared to be soaking the beans from 10 to 12 hours in a 0.5 per cent soda solution (about 1⅓ teaspoonfuls of soda per quart of water) at an initial temperature of from 50 to 100° C. (122 to 212° F.), followed by cooking in clear water. The method which gave the best results with hard water consisted in soaking the beans in a 0.05 per cent soda solution (⅛ teaspoonful of soda per quart of water) and cooking in the same water. With water that could be softened by boiling, as was the case with the tap water in the vicinity of the station, a preliminary boiling of the water for 10 or 15 minutes before adding the beans gave better results. Using a cooking utensil with a tight fitting lid and boiling the water so gently that little was lost on evaporation gave a product superior to those cooked in a large amount of water. With the pressure cooker products of good texture but inferior flavor were obtained.

The report includes the palatability score card used in judging the cooked products.

A study of the Japanese persimmon grown in Florida, I, II (*Jour. Home Econ., 22 (1930), No. 9, pp. 757–765, fig. 1*).—This study is reported in two parts as follows:

I. *Chemical analysis*, J. Tilt and R. B. Hubbell (pp. 757–762).—Included in this report are descriptions of several varieties of the persimmon grown more or less extensively at the present time, tabulated data from the literature on the chemical composition of several varieties, and more extensive data obtained in the present study on seven varieties grown in Florida. Minimum and maximum values expressed as percentage of the fresh pulp obtained in the present study were moisture 76.27 and 81.71, reducing sugar 11.55 and 17.39, protein 0.43 and 0.87, ash 0.3 and 0.58, and fiber 0.11 and 0.49 per cent. Attention is called to the fact that, except for a small amount of fiber, the carbohydrate in the persimmon occurs entirely as reducing sugars. The analysis of the ash of the two varieties Tane Nashi and Okami gave the following figures calculated on the basis of 100 gm. of fresh persimmon: Calcium 0.0086 and 0.0104 gm., phosphorus 0.0149 and 0.0205 gm., magnesium 0.0077 and 0.0106 gm. sulfur 0.0053 and 0.0093 gm., iron 0.479 and 0.489 mg., copper 0.047 and 0.090 mg., and manganese 0.124 and 0.304 mg., respectively

II. *The vitamin B complex*, J. Tilt, R. B. Hubbell, and L. Inman (pp. 762–765).—A preliminary study of the content of vitamin B (B and G) in the Tane Nashi variety is reported, with the conclusion that it is a very poor source of this complex.

Meat in nutrition, I–III (*Jour. Nutrition, 3 (1930), No. 3, pp. 303–330*).—The detailed report of an investigation at the Iowa Experiment Station, noted

previously from a preliminary report (E. S. R., 61, p. 387), is presented in three papers as follows:

I. *Preliminary report on beef muscle*, P. M. Nelson, M. H. Irwin, and L. J. Peet (pp. 303–311).—This paper describes the growth, reproduction, and lactation performances for three generations of albino rats on a diet of pressure cooked lean beef 50, cornstarch 30, dried brewery yeast 5, Osborne and Mendel salt mixture 4, butterfat 8, cod-liver oil 2, and sodium chloride 1 part. Control rats were fed a commercial dog biscuit and water ad libitum, supplemented by 30 cc. of whole milk daily and an occasional feeding of green food, usually lettuce.

The rats on the control ration reproduced and reared their young successfully through the three generations constituting the study. In the rats on the experimental diet excellent growth and reproduction were secured, but with numerous disasters in lactation such as cannibalism and failure of the milk supply. Supplementing the diet by increasing the yeast to 10 per cent, the salt from 4 to 5 per cent, and the meat to double the original quantity brought about no improvement. The rats showed evidence of early senility, as described by Simmonds (E. S. R., 54, p. 159), and on autopsy numerous hair balls were found in the stomach and intestines, as described by Mitchell, Bradshaw, and Carlson (E. S. R., 51, p. 664) and by Pappenheimer and Larimore (E. S. R., 53, p. 165).

II. *Some dietary factors influencing lactation*, L. J. Peet, P. M. Nelson, and E. A. Smith (pp. 313–323).—In a further effort to determine the nature of the deficiencies in the diet used in the preliminary study, the diet was modified by increasing the yeast from 5 to 15 per cent, increasing the amount of meat protein, increasing both protein and yeast, and adding, respectively, autoclaved yeast to supply additional vitamin G, tikitiki to supply the antineuritic vitamin B, lemon juice for vitamin C, and ether-extracted wheat germ oil vitamin E. These additions and changes were made during the latter part of pregnancy and throughout lactation. As controls, one group was kept on the basal diet without additions and one on a modified Steenbock stock diet. The following criteria were used for evaluating the results: (1) The age of the mothers when the first litter to be successfully raised was born, (2) the gain or loss in weight of the mothers during the lactation period, (3) the number of young successfully weaned, and (4) the weight and physiological condition of the young at weaning.

Considering these criteria in order, all of the diets except the basal and in some individual cases the extremely high meat diet enabled the mothers to bear litters at the normal age of about 3 months. The diets modified by the addition of tikitiki and wheat germ oil and the control basal diet were least efficient and those with added yeast and autoclaved yeast most efficient in maintaining the weights of the mothers during lactation. Including the 3 generations studied, the largest percentage of young born that were successfully weaned was on the increased meat diet plus 15 per cent yeast. In the first and second generations an even larger percentage of young was raised by the mother receiving the basal diet plus autoclaved yeast. The diet ranking highest with respect to the final criterion of average weights of young at 21 days was the increased protein diet plus 15 per cent yeast. A further experiment not completed suggests that even better results may be expected from increased meat plus autoclaved yeast.

These findings indicate the need for increased vitamin G during lactation.

III. *Hemoglobin formation*, L. J. Peet, E. A. Smith, and P. M. Nelson (pp. 325–330).—Duplicate determinations of the hemoglobin concentration of the blood of 82 rats from 21 to 30 days of age selected at random from the second and third generations on the various diets used in the above study show that

"the diets which contained, during the suckling period, an increased percentage of yeast, autoclaved yeast, tikitiki, lemon juice, or wheat germ oil, led to significantly greater hemoglobin formation in the young than the diets containing increased protein."

A bacteriological investigation of evaporated milk, J. Deming and H. Davis (*Arch. Ped., 48 (1931), No. 1, pp. 42-47*).—A bacteriological examination is reported of 154 cans of evaporated milk purchased in the open market in San Francisco. The examination included anaerobic and aerobic cultures at 37° C. for 102 and at 55° for 104 of the cans. No abnormality in appearance or odor of the milk was observed in any of the samples. Except for one anaerobic culture at 55° showing slight evidence of growth of a spore-forming Gram-positive rod, all cultures were found negative. It is concluded that from the bacteriological standpoint evaporated milk may be considered a safe food for use in infant feeding.

Utilization of milk and inorganic calcium and phosphorus, M. T. Potter and M. M. Kramer (*Jour. Home Econ., 22 (1930), No. 11, pp. 923, 924*).—Essentially noted from another source (E. S. R., 64, p. 895).

The iron content of liquid and reconstituted dry milk: A comparison, E. B. Hardisty (*Arch. Ped., 48 (1931), No. 2, pp. 108-116, figs. 6*).—A review of recent literature on the subject.

Iron requirement in early childhood, M. S. Rose, E. McC. Vahlteich, E. Robb, and E. M. Bloomfield (*Jour. Nutrition, 3 (1930), No. 3, pp. 229-235*).—This paper reports a study of the iron metabolism of a child 2 years, 7 months of age, on a simple normal diet calculated to be as near the minimum iron intake for equilibrium as possible. The experimental period consisted of 1 day before quantitative collections of the excreta were begun and 9 days of quantitative collections divided into three periods. Every precaution was taken to avoid contamination of the foods and excreta by dust and iron, and some one was constantly with the child to insure complete consumption of food and the collection of excreta without loss.

The foods included in the diet consisted of toasted whole wheat cereal, milk, orange powder, potatoes, pea pulp, prune pulp, and white bread. The average daily intake of iron for the three periods was 4.64, 4.58, and 4.70 mg. and the corresponding output 6.20, 4.88, and 6.13 mg., making the balances —1.56, —0.3, and —1.43, respectively. The fluctuations in the three periods were so slight as to lead to the conclusion that the child was very close to her minimum requirement, "which would appear to be about 5.70 mg." The energy value of the diet calculated from average analyses was 1,118 calories or 80 calories per kilogram of body weight, thus making the minimum requirement about 0.5 mg. per 100 calories. Allowing a surplus margin of 50 per cent for growth, the iron requirement for this child would be 8.5 mg. daily, equivalent to 0.76 per 100 calories. The recommendation is made that children from 2 to 3 years of age receive at least 0.75 mg. of iron per 100 calories.

A study in nutrition: An inquiry into the diet of 154 families of St. Andrews, E. P. Cathcart and A. M. T. Murray ([*Gt. Brit.*] *Med. Research Council, Spec. Rpt. Ser. No. 151 (1931), pp. 60*).—This report is based upon dietary records obtained by the authors, with the assistance of M. Shanks, for 1 week from 154 families representing all classes in the town of St. Andrews, Scotland. In the analysis of the data, consideration was given to calories, protein, fat, and carbohydrate, but no attention was paid to qualitative differences as determined by types of food making up the diets. The reason for this may be surmised from the following statement in the introduction: "Indispensable as the accessory substances may be, and we are still far from knowing their full significance, they are factors which, though vital, are accessory."

The 154 families included in the survey comprised in all 745 persons, with a family man value of 3.37 and a diet man value of 3.51. The former value was calculated from a scale which is essentially a combination of the earlier scale of Atwater and the later one of Lusk. The values in the present scale are man, 1; woman, 0.83; boy 14 years and up, 1; girl 14 and up, 0.83; child 12 to 14, 0.90; child 10 to 12, 0.80; child 8 to 10, 0.70; child 6 to 8, 0.60; child 3 to 6, 0.50; child 2 to 3, 0.40; child 1 to 2, 0.30; and child 0 to 1 year, 0.20. The diet man value takes into consideration the meals consumed not only by members of the family but by guests during the period in which the dietary records were obtained.

The diets averaged 3,119 calories per man per day, with a distribution in grams and percentage of total calories, respectively, of protein 83.8 gm. and 11 per cent, fat 118.6 gm. and 35.4 per cent, and carbohydrate 410.7 gm. and 53.6 per cent. The striking point about this average diet is thought to be the relatively low percentage of protein and the high fat. In this respect the diet is shown to differ markedly from the average standard diet of Voit and Rubner, but to approximate closely the average American diet. When the diets were grouped according to variations in weekly income a gradual increase in total calories with increase in income was evident. The greatest fluctuations were in fat content, which showed a gradual rise from 93.5 gm. per man per day at a low income level to 156.8 gm. at a high income level, these amounts representing a range of from 31 to about 41 per cent of the total calories. The increase in protein corresponded closely to increase in total calories, with the result that the percentage of energy derived from protein was practically identical, about 11 per cent, at all income levels. The percentage of energy derived from carbohydrate was also about the same in the different groups.

The average energy consumption per man per day of the various families grouped by occupation was sedentary 3,333, semimanual 3,279, manual 3,095, and unemployed 2,089 calories. The higher energy consumption of the sedentary than the groups presumably requiring more energy is discussed at some length. Among the various views offered in explanation, the one apparently most favored by the authors is that the so-called sedentary or professional group is of better physique than the so-called manual laboring group. "If this be so, then on the law of surface area it is obvious that the standard metabolism of the sedentary workers will be higher than that of the manual workers. This, along with the fact that the so-called sedentary workers take more systematic and on the whole more strenuous exercise than those fatigued by manual work, which in itself may be steady, but not from a muscular point of view exhausting, or, in many instances, even trying, would offer a plausible explanation for the greater calorie value of the food ingested."

An attempt to classify the families by social status, depending upon the nature of the occupation, showed no uniformity among members of the same group other than the tendencies noted previously for different income levels. Family appetite and taste appeared to govern food selection. A wide variation existed in the percentage of income spent for food. The average percentage in the case of 21 families whose incomes were known was approximately 54 per cent, but the range was from 106 to approximately 21 per cent. "There is no obvious relation between the expenditure and any known factor except the natural tendency for the percentage expenditure on food to rise as incomes go down. It almost certainly lies in family idiosyncracy, possibly often the desire to keep up appearances not commensurate with the income. As the other costs are high, the sacrifice is made in food."

A comparison of the diets for two different weekly periods of a group of families showed that the chief determining cause of such differences as were

noted between the two periods was the question of income level. An attempt was made to determine the relation between the "effectiveness" or "capacity" of the parents and the family diet and between the physical condition of the children and the diet, but with not very conclusive results.

An appendix contains data obtained from a study of 5 families to determine the relative distribution of food among the various members of the family as compared with the standards adopted. This comparison revealed the fact that the men received about 12 per cent more calories, chiefly from protein and fat, than the standard man value, and that the intake of the women was below the established standard. With the average consumption of the men as 1, the adjusted percentage factor for the women became 0.7 instead of the standard 0.83. It is noted, however, that many more families must be studied before any final conclusion can be reached concerning these standards.

The basal metabolism of the Filipinos, M. Ocampo, N. Cordero, and I. Concepcion (*Jour. Nutrition, 3 (1930), No. 3, pp. 237–244*).—The studies reported were undertaken primarily to set up basal metabolism standards for medical practitioners in the Philippine Islands. The determinations were made during the four months of the cool season on 104 healthy subjects, 88 men and 16 women, most of whom were medical students, with some laboratory helpers, a few professors, and outsiders. Most of the subjects were between 20 and 30 years of age. The Benedict-Roth respiration metabolimeter was used with the usual technic. Duplicate determinations were made on each subject on two and sometimes three different days. The lower values for each day were averaged for the final readings.

Of the entire number, only 16 showed a plus metabolism and of these 9 had a plus value of not more than 1.5 per cent. The average deviations from the Harris-Benedict standards were −5.6 per cent for the men and −10.6 per cent for the women. Accepting the claim of Benedict that the present standards for women are about 5 per cent too high, the degree of lowering of the metabolism of the women in the present study was about the same as of the men. The deviations from the Aub-Du Bois standards were −7.8 and −9.3 per cent, respectively.

Two of the subjects whose basal metabolism had been determined previously in a temperate climate showed no appreciable differences over the earlier figures.

These data are thought to point to a low basal metabolism for Filipinos. In discussing these findings and other observations on basal metabolism in the Tropics reported in the literature, the authors state "it is probable that climate is in the last analysis responsible for the different levels of metabolism of different racial groups, but that such an influence becomes manifest after generations of adaptation, or at any rate after a longer period than the span of an ordinary adult lifetime."

The inclusion of all European and American subjects under the general term white race and of all inhabitants of the Far East under the general term oriental is considered unsatisfactory owing to the definite effect of racial and climatic factors on metabolism.

Old and new emphases in the teaching of nutrition, M. S. Rose (*Jour. Home Econ., 22 (1930), Nos. 11, pp. 878–884; 12, pp. 977–982*).—This discussion of changing emphases in the teaching of nutrition is based on an address delivered at the 1930 annual meeting of the American Home Economics Association.

A new nutrition factor [trans. title], A. Bakke, V. Aschehoug, and C. Zbinden (*Compt. Rend. Acad. Sci. [Paris], 191 (1930), No. 23, pp. 1157–1159*).—During the course of feeding experiments on rats, using a basal diet free from

the vitamin B factors and supplementing it with a wheat germ concentrate, it was noticed that the fur of black or pied rats turned silver gray. With yeast as the source of the B factors the change in color took place occasionally, but not always. Supplementing the wheat germ with an extract obtained by ether or alcohol extraction of the wheat germ was without effect, but entire wheat restored the black color in a short time.

In a duplicate series of experiments in which separated wheat germ and entire wheat served as the sources of vitamin B, respectively, the change in color of the fur took place with the wheat germ but not with the whole wheat.

Vitamins in canned foods.—IX, Tomato products, E. F. KOHMAN, W. H. EDDY, and C. ZALL (*Indus. and Engin. Chem., 22 (1930), No. 9, pp. 1015–1017, figs. 3*).—In continuation of the series of papers noted previously (E. S. R., 62, p. 396), data are reported on the content of vitamins A, B (old), and C in green tomatoes, raw and canned; in green-picked tomatoes, air-ripened and tested raw and canned; and in a number of tomato products canned commercially by customary methods.

In the studies on green and air-ripened tomatoes, it was concluded that the vitamin A content of green tomatoes almost doubles on ripening, that canning either the green or ripe tomatoes has little or no effect on their vitamin A content, that there are no great differences in the vitamin B content of green and ripe tomatoes, raw or canned, and that green tomatoes, raw or canned, are less rich in vitamin C than ripened green-picked tomatoes, raw or canned.

The various commercial products tested as numbered by the authors were as follows: (No. 7) Whole ripe tomatoes canned by the usual commercial procedure; (No. 4) cyclone juice from similar tomatoes canned in No. 1 cans, processed 20 minutes in boiling water; (No. 5) cyclone juice concentrated in a vacuum pan at 140° F. for 2.5 hours to the pulp stage and canned as No. 4; (No. 6) pulp concentrated as in No. 5, concentrated 2 hours longer to paste stage, and canned; (No. 8) cyclone juice treated with celite and filtered to remove the red pulp, the clear filtrate heated to 155° in buckets surrounded by hot water, filled into No. 1 cans, and cooked 10 minutes in boiling water; (No. 10) cyclone juice heated without filtering to 155° and canned after 1.5 hours; (No. 9) cyclone juice evaporated to pulp in an open wooden tub with heated copper coils; (No. 11) juice from peeled tomatoes filled into cans, passed through a steam exhaust, closed, processed for 10 minutes, and cooled; and (No. 12) cyclone juice made by preheating tomatoes to boiling point with live steam, filled into cans, processed for 10 minutes, and cooled. The usual cyclone juice is prepared by placing the tomatoes in a perforated sheet of metal in the form of a cylinder in which there are rapidly revolving baffles that force the pulp and juice through the perforations, thereby entrapping air in the pulp in the form of tiny bubbles.

The data obtained in feeding tests, using at least three varying amounts for each vitamin and 3 animals for each dosage, indicate that on the basis of equivalent levels of total solids the various products were of the same vitamin A potency with the exception of No. 8. In other words, the potency varied with the degree of concentration. Similar results were obtained in the vitamin B tests in regard to the relation of potency to concentration, and a similar loss was noted in the filtered product No. 8. Concentrate No. 10 was also lower in its B content, suggesting loss by oxidation.

The most potent product with respect to vitamin C was the regularly canned tomato. Losses in the other products were apparently not the result of the concentration but of the preparation of the cyclone juice, since lots Nos. 11 and 12 showed much less destruction. The processes which prevented the action of en-

Steam in particular afforded a protecting envelope. "If this explanation is accurate, this principle should be of considerable importance, as it should find application in many processes in the canning and cooking of foods. By performing any operation on food products in steam, grinding, grating, crushing, etc., could be accomplished without contact with air. In the present state of our information as to the effect of various processes on vitamins, this should not be assumed to be a cure-all, but needs in each instance to be checked by actual tests."

Variations in vitamin A and in chemical composition of corn, G. S. Fraps (*Texas Sta. Bul. 422 (1931), pp. 46*).—This complete report of an investigation, which has been noted previously from progress reports (E. S. R., 63, p. 464), contains a brief description of the vitamins known at present, and a review of the literature dealing with the vitamin A content of corn; a discussion of the relative merits of what the author terms the ration method and the unit method of determining vitamin A; tabulated data by the unit method of the content of vitamin A in yellow, red and variegated, and white corn, with a discussion of the relation of vitamin A to heredity and the variations according to season and locality; a few data on the distribution of vitamin A in the milling products of white and yellow corn; proximate and mineral analyses of varieties of corn grown at different substations in the State; and data on the protein content of corn in comparison with rainfall in different seasons.

In the so-called ration system the corn to be tested constituted part of the diet, which consisted of corn 130, cottonseed oil 20, yeast 10, purified casein 32, and salt mixture 8 parts. This ration was fed to rats from weaning without a preliminary depletion period, the aim being to secure normal growth. The unit method was that of Sherman and Munsell (E. S. R., 54, p. 89). This was found to be much more satisfactory than the ration method, although considerable difficulty was experienced in estimating the amount of material which would produce exactly the desired gain. It was found desirable to estimate the quantity of vitamin A from the results on two groups of rats, one gaining less than 3 gm. and the other a little more than 3 gm. a week during the 8 weeks' period. In testing the samples of white corn of extremely low vitamin A content, some yellow corn of a know vitamin A content was incorporated in the basal ration and the additional gain above that due to the yellow corn was attributed to the vitamin in the material being tested. A comparison is given of the results obtained in testing several samples of corn by both methods, but the unit method was followed in the greater part of the work reported.

Data were obtained on 20 samples of Ferguson Yellow Dent corn grown in 11 different localities and during three seasons, and on 19 samples of other varieties of yellow corn grown in different localities. One gm. of the Ferguson Yellow Dent corn furnished from 2.5 to 7 units of vitamin A, the variations being due to both season and locality. In other varieties of yellow corn the number of units per gram varied from 5 to 8. The varieties of variegated and of red corn (18 samples) tested were Fentress Strawberry, 1 gm. of which contained from 0.9 to 2.9 units of vitamin A, and Bloody Butcher, which contained from 1.8 to 2.5 units. Both varieties not only contained less vitamin A than yellow corn, but were also more variable. White corn contained so little vitamin A that the amount could be estimated only approximately. In crosses of white and yellow corn the units of vitamin A, as noted more fully on page 216, were approximately in proportion to the number of genetic factors for yellow endosperm present.

Studies of the distribution of vitamin A in milling products of white corn indicated a slightly higher content in unbolted corn meal than in whole corn, [illegible] bran, or hominy feed. The units of vitamin A per gram in yellow corn

and various milling products were given as corn 5, golden corn meal 3, yellow granulated corn meal 3, and yellow hominy feed 1.5.

No significant variations in the proximate or mineral analyses were found in the different varieties of corn, but corn grown in different localities showed variations in content of lime and phosphoric acid and even greater variations in protein. The protein content varied not only with the locality but also with the season. There was a significant correlation between the protein content and rainfall, the correlation coefficient being -0.576 ± 0.072.

A study of the absorption and retention of vitamin A in young children, J. I. ROWNTREE (*Jour. Nutrition, 3 (1930), No. 3, pp. 265–287*).—The general plan of this investigation was to extract the feces and urine of children receiving various amounts of vitamin A and feed these extracts to vitamin A-deficient rats, using for purposes of comparison extracts of the diets given the children. In preliminary experiments the subjects consisted of 4 normal and 4 diabetic preschool children on diets containing from 116 to 150 gm. and 60 gm., respectively, of fat, but equivalent amounts of other constituents. In the main experiments 4 normal infants from 2 to 8 months of age served as subjects. Their basal diet consisted of sweetened whole milk soured by lactic acid, with supplements of cod-liver oil and orange juice. For variations in the content of vitamin A sieved carrots or egg yolk were added, the cod-liver oil was omitted, and in one case skim milk was substituted for the whole milk.

Entirely negative results were obtained when extracts of the urine of the infants and older children were fed as the sole source of vitamin A to rats which had shown xerophthalmia for 3 days on the basal vitamin A-free diet. In the preliminary tests with older children, equivalent gains were made by rats receiving 6 per cent of the fecal extract and 0.45 per cent of the food extract. Other rats receiving half as much of the fecal extract and the food extract, respectively, likewise made similar gains, showing that they were receiving equivalent amounts of vitamin A from the feces and food extracts and that consequently between 7 and 8 per cent of the ingested vitamin A was lost through the feces. That the growth of rats receiving the extracted feces was due to vitamin A and not other substances extracted from the feces was demonstrated by the failure to promote growth of a similar extract of feces in which the vitamin A had been destroyed by oxidation with ferrous sulfate and exposure to air.

In the experiments on infants, each diet was fed for at least 9 days and the fecal collections were made during the last 6 days. As calculated from tables given by Sherman, the basal diet contained about 2,000 units of vitamin A, the basal diet with cod-liver oil, eggs, or carrots 3,000, with cod-liver oil and egg 4,000, and with all additions nearly 5,000 units. The skim milk diet was estimated to contain not more than 200 units. Irrespective of the amount of vitamin A in the diet, all of the infants excreted some vitamin A through the feces. Those receiving skim milk excreted more vitamin A than they ingested. The losses in the feces were greatest, however, during the period of high vitamin intake and least during periods of low intake. In no case was more than 16 per cent of the vitamin A of the diet excreted.

Since the fecal fat excretion of infants is normally within the same percentage range, it is concluded that the loss of vitamin A runs parallel with that of fat. The vitamin A of egg yolk and cod-liver oil appeared to be equally well utilized, but the amount of carrots which the infants would take was too limited to show conclusively the extent of utilization of the vitamin A of carrots.

The vitamin B and G contents of certain yeast samples, E. J. QUINN, F. B. WHALEN, and J. G. HARTLEY (*Jour. Nutrition, 3 (1930), No. 3, pp. 257–263,*

figs. 2).—The samples of yeast used in this study included two of brewers' yeast, one of an eastern product labeled "dry powdered yeast," one of fresh starch-free bakers' yeast, and one labeled "pure dehydrated yeast" obtained from a mid-western manufacturer. One of the samples of brewers' yeast was a Canadian top yeast that had been dried at the plant in steam-heated drums and then ground to a rather coarse powder. The other was a fresh moist sample of bottom yeast from a New York City plant. This and the fresh starch-free yeast were dried in thin layers at room temperature in the laboratory before being tested. The Chase method (E. S. R., 63, p. 95) was followed in the B tests and the Bourquin method in the G tests.

In the vitamin B tests both samples of brewers' yeast were definitely more potent than the other samples. Better growth was secured on 25 mg. daily of the Canadian sample than on 250 mg. daily, and about the same growth as on 500 mg. daily, of the dry powdered yeast. The commercially dried yeast had approximately the same potency as the yeast which had been carefully dried in the laboratory. This is thought to indicate that the smaller amounts of vitamin B in certain of the samples were not due wholly to a destruction of the vitamin as the result of drying.

A relatively uniform amount of vitamin G was present in all of the samples. From 75 to 150 mg. daily of any of the samples was sufficient for the unit growth adopted as standard. The amounts of the Canadian sample of brewers' yeast required to produce the same amount of growth when fed as the sole source of vitamins B and G, respectively, were 25 and 150 mg. In this and the other sample of brewers' yeast, vitamin G was thus the limiting factor, while in the other three samples of yeast vitamin B was the limiting factor.

Vitamin B.—Assay and vitamin B_1. Vitamins B_2 and B_3: Bios (*Nature* [*London*], *127* (*1931*), *Nos. 3194, pp. 95, 96; 3195, pp. 131–133*).—These two papers consist of concise reviews of recent literature dealing, respectively, with the concentration and determination of vitamin B and with the properties and differentiation of vitamins B_2 and B_3 and bios.

Rickets prophylaxis by means of minimal irradiation [trans. title], H. Vollmer (*Klin. Wchnschr., 9* (*1930*), *No. 49, pp. 2300–2302*).—As a result of clinical experience in the ultra-violet irradiation treatment of infantile rickets, the author concludes that the customary dosage is too high and that it is only as a result of the protective economy of the organism that actual harm does not follow such overdosage. In his opinion there is no great difference between the effective prophylactic and therapeutic dosage. An average dosage of 100 irradiation minutes is considered sufficient to heal existing rickets or protect against rickets for an entire winter. In practice, a weekly exposure for about 4 or 5 minutes of the breast and back (distance about 80 cm.) is considered in the neighborhood of the effective minimal dosage.

The treatment of pernicious anemia with preparations of hog stomach [trans. title], N. Henning and G. Stieger (*Klin. Wchnschr., 9* (*1930*), *No. 46, pp. 2145–2147*).—This paper consists chiefly of a discussion, illustrated by clinical data, of the mode of action of preparations of hog stomach in pernicious anemia. The mucous membrane, carefully freed from muscle and dried to a powder, was very effective, but a hydrochloric acid alcohol extract of the membrane was ineffective. The antianemic properties were present both in the fundus and antrum portions of the membrane. A peptic enzyme was not present in the antrum membrane and present in only small amounts in the other portions. This is thought to indicate that the action of the membrane in the treatment of primary anemia is independent of the peptic digestion of proteins, and that the active material contains a substance which acts directly in blood regeneration.

The ineffectiveness of manganese in nutritional anemia, W. E. Krauss (*Jour. Biol. Chem., 90 (1931), No. 1, pp. 267–277, figs. 5*).—On account of the contradictory findings reported by Titus, Cave, and Hughes in Kansas (E. S. R., 61, p. 791) and Waddell, Steenbock, and Hart in Wisconsin (E. S. R., 62, p. 688) in the use of the same manganese salt in studies of the rôle of manganese in hemoglobin regeneration, the author undertook to repeat their work at the Ohio Experiment Station, using samples of copper sulfate, manganous chloride, and ferric chloride from the Wisconsin Experiment Station and manganous chloride and iron chloride from the Kansas Station. The technic followed was that previously described (E. S. R., 61, p. 490).

No difference in response resulted when the salts prepared in the different laboratories were fed simultaneously to rats of the same litters. Manganese, whether added alone (0.1 mg.) or in combination with iron (0.5 mg.), brought about no improvement in rats suffering from nutritional anemia. It is suggested that the conflicting results reported were probably not due to impurities in the salts used, but to slight differences in the technic of housing and feeding the experimental animals.

Studies in pernicious anaemia of pregnancy.—Part III, Determination of normal blood standards for the nutritional laboratory's stock albino rat, L. Wills and M. M. Mehta (*Indian Jour. Med. Research, 18 (1930), No. 1, pp. 307–317, pl. 1, figs. 4*).—In this contribution from the Nutritional Research Laboratory, Pasteur Institute, Coonoor, India, blood findings are reported for 220 normal albino rats from the age of 1 day to 6 months and over, including a group of adult nonpregnant and 1 of pregnant females. A comparison of the results with those quoted in the literature showed no significant differences in red cell counts, white cell counts, and hemoglobin values, lower values for differential counts than English figures and still lower than American figures, and low figures for the diameters of the red cells.

Pregnant rats showed no significant differences from nonpregnant beyond a very slight lowering of the red cell and hemoglobin count at the end of pregnancy. It is noted that these results are directly opposed to those of Sure, Kik, and Walker (E. S. R., 61, p. 792), who reported severe anemia in pregnant rats.

HOME MANAGEMENT AND EQUIPMENT

Investigation of various factors affecting the heating of rooms with direct steam radiators, A. C. Willard, A. P. Kratz, M. K. Fahnestock, and S. Konzo (*Ill. Univ., Engin. Expt. Sta. Bul. 223 (1931), pp. 104, figs. 51*).—Studies conducted by the Illinois Engineering Experiment Station, in cooperation with the Institute of Boiler and Radiator Manufacturers and the Illinois Master Plumbers' Association, are reported.

The results show that the steam condensation of a direct cast-iron radiator, expressed in pounds of condensate, is not an adequate measure of the performance of the radiator. The heating effect produced on the air in the room must be taken into consideration in making comparisons between different types of radiators. Long, low, thin cast-iron radiators placed under windows heat a room more comfortably and more economically than higher column or tubular radiators similarly placed, and maintain materially better floor to ceiling temperature differentials.

The larger portion of the temperature differential in a room heated with direct steam cast-iron radiators of the column and tubular types occurs between the floor and the breathing level. The temperature used as an indication of

whether a room is properly heated or not should be observed at some level nearer the floor than the breathing level. The 30-in. level is tentatively suggested as more representative of conditions in the zone of human occupancy.

The use of a properly designed inclosure or shield on a tubular or column type of radiator results in a gain in steam economy and equally or more satisfactory air temperature conditions in the room. The use of an improperly designed inclosure, however, results in a reduction in steam condensation and in unsatisfactory air temperature conditions.

A properly designed inclosure or shield should offer a minimum of resistance to the flow of air over the radiator under gravity head, and should protect the wall back of the radiator against the effect of direct radiation from the radiator. It should have the top of the opening in the face of the inclosure as high as possible and permit free access of air over the lower half of the radiator, especially near the floor. No material gain in economy or room temperature conditions may be realized from the use of an inclosure or shield on a wall type of radiator. Increasing the size of an inclosed or an uninclosed radiator results in a uniform increase in the room temperature at all levels in the room and an increase in the steam condensation. The steam condensation, however, increases at a greater rate than the increase in indoor-outdoor temperature difference, and it is not safe to predict the steam condensation for one size of radiator from the room temperature gradient curves and steam condensation for another size. Both steam condensation and room air temperature conditions are affected by the location of the heating unit. In general the location under a window in the exposed wall is to be preferred to a location near an unexposed or warm wall. The location near the ceiling is a most unfavorable location for a radiator and is not to be recommended.

Painting a radiator or inclosure with an oil paint, irrespective of the color of the paint, has no material effect on the heat transmission as compared with that for foundry finish or oxidized iron. Galvanizing or painting with metallic bronze paint reduces the heat transmission from an inclosed or uninclosed radiator below that obtained with oil paint. The reduction is approximately 9 per cent in the case of uninclosed tubular or column radiators.

The use of an inclosure having clearance between the radiator and the back of the inclosure reduces the temperature of the wall surface back of the radiator approximately 45° F. below that obtained with an uninclosed radiator. The use of an inclosure with a galvanized back, or one painted with metallic bronze paint, reduces the temperature of the wall surface back of the inclosure from 10 to 25° below that obtained with an inclosure with the back painted with oil paint. In this respect galvanizing is slightly more effective than gold or aluminum bronze.

The use of storm sash alone does not materially affect the room air temperature conditions, but it did effect a gain in steam economy of approximately 11 per cent in the particular room tested. The use of a storm door alone improves room air temperature conditions, and in the particular room tested effected a gain in steam economy of approximately 21 per cent. The use of both storm door and storm sash improves room air temperature conditions, and in the particular room tested effected a gain in steam economy of 31.7 per cent. The actual saving, in general, will be dependent on the ratio of window and door area to exposed wall area and on the air-tightness of the storm door and sash.

Variations in basement and attic temperatures do not have a material effect on room air temperature conditions. Variations in the amount and arrangement of the exposed walls may have a very material influence on both room air temperature conditions and steam economy. The degree of comfort experienced

by the occupants of a room is greatly influenced by the temperature of the inner surface of the walls as well as by the temperature of the air in the room.

The temperature of the inside surface of exposed standard frame walls varies from 67 to 59° for walls not exposed to air movement and from 65 to 53° for walls exposed to an air movement of approximately 10 miles per hour as the outdoor temperature ranges from 40 to −10° and the indoor temperature remains constant at 72.5°. The temperature of the inside surface of single-pane glass without storm sash, and with an outdoor temperature of −2°, is approximately 33° when not exposed to air movement and 17.5° when exposed to air movement of approximately 10 miles per hour. The temperature of the inside surface of the inside glass pane when storm sash is used, and with an outdoor temperature of −2°, is approximately 52° when not exposed to air movement and 41° when exposed to air movement of approximately 10 miles per hour.

The use of curtains and shades does not materially affect the room air temperature conditions and steam economy, but does serve to increase the degree of comfort of the occupants by shielding them from radiation to the cold glass surfaces.

The care and repair of the home, V. B. Phelan (*Garden City, N. Y.: Doubleday, Doran & Co., 1931, pp. XIV+306, figs. 30*).—This book is a brief popular treatise on home maintenance and repair. It contains the following chapters: Inspection of the house and its equipment, foundation walls and basements, exterior walls, interior walls, roofs and roof drainage, doors and windows, weatherproofing and insulating, heating and ventilating, plumbing and water system, painting and varnishing, electricity, and miscellaneous.

MISCELLANEOUS

Forty-first Annual Report [of New Mexico Station, 1930], F. Garcia (*New Mexico Sta. Rpt. 1930, pp. 108, figs. 15*).—This contains the organization list, a report of the director on the work and publications of the station, and a financial statement for the year ended June 30, 1930. The experimental work reported is for the most part abstracted elsewhere in this issue. Production records with milch goats are also included.

Progress report, Carbon County Experimental Farm, 1927–30, inclusive, I. D. Zobell and G. Stewart (*Utah Sta. Bul. 225 (1931), pp. 20, figs. 7*).—The experimental work reported is for the most part abstracted elsewhere in this issue. Rainfall and frost data are also included.

[Report of West Virginia Station, 1928–1930], F. D. Fromme (*W. Va. State Bd. Control Rpt., 10 (1928–1930), pt. 2, pp. 69–94, pls. 4*).—This contains the financial reports for the fiscal years ended June 30, 1928, June 30, 1929, and June 30, 1930, and reports of the director and State Board of Control on the work and publications of the station during this period.

NOTES

Arizona University and Station.—R. S. Hawkins, professor of agronomy and agronomist; E. B. Stanley, professor of animal husbandry and animal husbandman; Stella Mather, head of the university department of home economics; and M. F. Wharton, assistant professor of horticulture and assistant horticulturist, have been granted sabbatical leave for the ensuing year; Dr. P. S. Burgess, professor of agricultural chemistry and agricultural chemist, and Dr. R. B. Streets, associate professor of plant pathology and associate plant pathologist, for the first half of the year; and W. G. McGinnies, associate professor of range ecology and range ecologist, for the second half of the year. Dr. R. L. Matlock has been appointed assistant professor of agronomy and assistant agronomist beginning June 1.

Iowa College and Station.—According to a note in *Iowa Agriculturist*, the State appropriations for the college and station have been reduced by $216,000 for the ensuing biennium.

Minnesota Station.—The State legislature has made provision for increased facilities for both field crop and horticultural plant breeding investigations. An appropriation of $30,000 was made for the erection and equipment of a farm crops field house at University Farm. This will be used for the curing and storing of nursery and increase stocks and will contain weighing, drying, and preparation rooms and facilities for cleaning and storing seed stocks of various kinds. For the fruit farm near Zumbra Heights in the Lake Minnetonka district, $9,000 was appropriated for the purchase of additional land and $13,500 for an office building and laboratory. Nearly all of the investigations in fruit crop breeding are conducted at this farm, and the laboratory will provide much-needed facilities and greatly expedite the making of records and the interpretation of results.

Ohio State University.—Felix H. Helmreich, assistant professor of animal husbandry, has resigned to engage in commercial work.

Wisconsin University and Station.—Dr. S. M. Babcock, professor emeritus of agricultural chemistry, died July 1 at the age of 88 years. An account of his life and work will appear in a later issue.

Wyoming University and Station.—Dr. Cecil Elder, head of the department of veterinary science and bacteriology, has accepted a position at the Missouri University and Station, mainly for research in animal diseases, beginning September 1. M. A. Alexander, assistant professor of animal husbandry and assistant animal husbandman, has accepted a position in the Nebraska University and Station, which will include teaching and sheep experimental work and will begin July 1. T. J. Dunnewald, assistant in soils investigation, and S. S. Wheeler, associate professor of animal husbandry and assistant animal husbandman, have been granted sabbatical leave, beginning September 1, to be spent in graduate work at the University of Wisconsin and the Iowa College, respectively. Alden S. Ingraham has been appointed to carry on the duties of Prof. Wheeler.

Office of Experiment Stations.—Director James T. Jardine of the Oregon Station has accepted appointment as chief of the Office, thereby filling the vacancy which has existed since the death of Dr. E. W. Allen on November 11, 1929. It is expected that he will assume his new duties about September 16.

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EDITORIAL

THE PENNSYLVANIA SOIL FERTILITY CONFERENCE

From the standpoint of agricultural science, the outstanding gathering of the past summer has doubtless been the Soil Fertility Conference, held at the Pennsylvania State College from June 24 to 26. This conference was primarily a commemorative gathering, its immediate occasion being the celebration of the fiftieth anniversary of the Pennsylvania soil fertility plats. Established in 1881, these plats constitute the oldest continuous soil fertility experiments in the Western Hemisphere and are exceeded in age only by the classic undertaking which began in 1843 on Broadbalk Field at the Rothamsted Experimental Station in England. Little ceremony and scarcely more than local notice seems to have attended the original installation of the plats, but interest in them has greatly widened with the passing of the years and their attainment of a full half century is a milestone amply deserving of formal recognition.

The plats were laid out on their present basis by Dr. Whitman H. Jordan, then professor of agricultural chemistry in the college. The program as originally prepared contemplated the return of Dr. Jordan for the occasion as the guest of honor, and the death on May 8 of this central figure resulted in various modifications in the exercises. In the place of the reminiscences from his lips which had been expected to constitute the motif of the gathering, impressive tributes to his memory were delivered by Dr. S. W. Fletcher, director of research in the Pennsylvania Station, and by other speakers, and announcement was made that the plats themselves had been formally designated by the trustees of the institution as the Jordan Soil Fertility Plots.

The conference program was arranged to include an inspection of these plats, which occupy a tract of about 20 acres in a conspicuous location on the college grounds. This is divided into 144 plats of ⅛ acre each, arranged in 4 tiers of 36 plats each and devoted to the typical Pennsylvania 4-year rotation of corn, oats, wheat, and mixed clover and timothy. Treatments with farm manure, various commercial fertilizers, and lime have been systematically applied over the 50-year period. An idea of the extensiveness of the enterprise

is afforded by the statement that 12,000 separate entries are required in recording the yields alone.

The results of the experiments formed the theme of two sessions of the conference. Various phases were presented in considerable detail by members of the Pennsylvania agronomy and chemistry staffs, each being followed by a discussion by a speaker from another institution. Thus, an introductory paper on the origin, nature, and extent of the Hagerstown soil itself by Prof. A. L. Patrick was amplified by Dr. C. F. Marbut of the U. S. D. A. Bureau of Chemistry and Soils; the economic returns from the plats were evaluated by Prof. F. D. Gardner and discussed by former Director C. E. Thorne of the Ohio Station; and nitrification and soil respiration in relation to plat yields were considered by Profs. C. D. Jeffries and F. J. Holben, respectively, with discussions by Drs. A. B. Beaumont and S. A. Waksman of the Massachusetts and New Jersey Stations. In the same way the effect of fertilizer treatment on the content of exchangeable cations was taken up by Prof. F. G. Merkle and discussed by Dr. Richard Bradfield of Ohio State University; the nitrogen balance in a 4-year grain rotation by Prof. J. W. White, with discussion by Dr. J. A. Bizzell of Cornell University; the reciprocal effects of nitrogen, phosphoric acid, and potash on absorption by plants by Dr. Walter Thomas, with discussion by Prof. Emil Truog of the Wisconsin Station; and the comparative effects of the different phosphates on yield and maturity by Dr. C. F. Noll, with discussion by Mr. S. D. Conner of the Indiana Station. This series of papers of direct agronomic interest was appropriately concluded with a comprehensive and enlightening address entitled The Nitrogen Outlook, by Director J. G. Lipman of New Jersey.

Opportunity was also afforded during the conference for a study of other near-by field experiments of the Pennsylvania Station, including those dealing with the use of fertilizers for field crops, vegetables, and orchards, the soil fertility plats on the DeKalb soil at Snow Shoe, and the recently established pasture soil fertility plats at Kylertown. The conference was further supplemented by a dinner and business meeting of the northeastern section of the American Society of Agronomy, so that from a technical agronomic point of view the week was one of unusual attractiveness and profit.

Interest in the conference, however, was much broader than agronomy, and in the historical aspects of the occasion may lie its fullest significance. Valuable as the plats themselves have proved for their specific contribution to farm practice, their service as an early shifting of attack to a more sound and basic method of experimentation is perhaps of even greater importance. Although laid out about six years before the passage of the Hatch Act, these plats do

not of course mark the beginnings of field experiments in this country. Experiment stations were already in operation in Connecticut, California, North Carolina, New York (Cornell), and New Jersey, and in other States more or less definite provision had been made for its prosecution. In Pennsylvania itself, plat experiments and similar tests had been begun as early as 1857 by Prof. William G. Waring, antedating the formal opening of the Farmers' High School which later became the Pennsylvania State College. Prof. Waring's work was continued and somewhat elaborated by Dr. Evan Pugh, the first president of the college and a former member of the Rothamsted staff, and in 1868 President Thomas H. Burrows planned and laid out a somewhat elaborate system of plat experiments not only on the college farm but on two additional farms which had been acquired in other parts of the State. Up to 1881, however, no attempt had been made in this work to continue the same treatment on the various plats year after year, and the residual effect alone of fertilizers applied in previous years often tended to vitiate the results. Under Dr. Jordan's plan, not only were as uniform and carefully checked plats prepared as could be obtained, but the work was "to be continued for a number of years sufficient to determine the ultimate effect and value of the different methods of manuring employed." It is this shifting of emphasis from the transient and superficial to the permanent and thoroughgoing that distinguishes his contribution to this type of work and marks the beginning of a new era in experimentation in this field well worthy of remembrance and commemoration.

The death of Dr. Jordan probably removed the last of the pioneer workers with these plats, but many details as to their early history were graphically recounted by Director H. J. Patterson of the Maryland Experiment Station, assistant chemist of the station from 1886 to 1888, and by President Enos H. Hess of Messiah Bible College, assistant to the director from 1894 to 1901. It was President Hess who made the first chemical studies of these plats and prepared the results of the first 16 years. The broad significance of the work was further brought out in the welcoming remarks of Dean Watts, the addresses of Director Fletcher, Prof. Gardner, and others of the staff, and in the closing paper by Dr. Henry G. Knight, chief of the U. S. D. A. Bureau of Chemistry and Soils, entitled Fifty Years of Soil Fertility Investigations.

Discussing the value of continuity in such experiments, Dr. Knight pointed out that "following the establishment of the soil fertility experiment in Pennsylvania, other stations, notably Ohio, Illinois, and Massachusetts, started permanent fertilizer experiments, while other stations throughout the United States have from time to time established field experiments to determine the effect of different

kinds and amounts of plant food materials and their mixtures on the yield and quality of different crops. In some cases these field experiments, like that at State College, have been continued for many years, their value, as experimental assets, increasing with time." The value of these long-continued soil fertility and fertilizer experiments, he stated, "lies not alone in resulting yields, even though of great practical significance, but also in the opportunity afforded for carrying on laboratory and greenhouse investigations involving soil chemistry, soil physics, soil microbiology, plant physiology, and other branches of agricultural science. It is difficult to overemphasize the importance of continuing the long-time fertilizer plats at State College without any disturbance or change, as nowhere in the world, except in the case of the Rothamsted experimental plats, does a more favorable opportunity exist for studying the effect of climate, crop rotation, and fertilizers upon the yield and quality of the crops grown, and for periodically following the progressive changes which are taking place in the soil."

Dr. Knight went on to review as comprehensively as possible the extensive developments in soil research in this country, citing the many soil surveys, the use of cylinder and lysimeter methods, and the studies of soil organic matter, soil reaction, chemical and biological methods for determining fertilizer requirements of crops, and the changes under way in fertilizer practice. The complex nature of many of these problems was emphasized, and it was pointed out that "in all of these investigations toward the solution of which the experiment stations are lending their support and active cooperation, it is being forcibly demonstrated that soil problems are so ramifying that the advantage of group attack by different scientific workers is of great importance. Soil fertility and fertilizer research affects not only the soil scientist but the agronomist, the entomologist, the plant physiologist, the plant pathologist, the geneticist, the chemist, and physicist as well. It seems to me, therefore, that future soil fertility research will have to depend more and more upon an alignment of scientific workers mutually engaged in the solution of problems pertaining to soils, plant nutrition, and crop production; that the advantage of group attack in attempting the solution of such problems appears self-evident; and that, through such organization, points which may appear obscure or not readily appraised will become clearer by means of such scientific partnerships."

The further suggestion was ventured that "future soil fertility and fertilizer research should be developed on a comprehensive scale and in such a way that a national viewpoint is the objective. A national unification and coordination of soil fertility and fertilizer research by the State experiment stations and the United States

Department of Agriculture along regional lines based on soil, climatic, and crop characteristics has been advocated, and this should be a goal to strive for."

To carry out this plan, Dr. Knight regarded as essential the division of the United States into "perhaps nine or ten natural regions with a regional director of research in charge of each"; the establishment of cooperative relationships between State experiment stations within the regions through "a board of research control composed of station soil fertility workers and agronomists who would aid the regional director in outlining administrative and scientific policies"; "a central office and a national director, the duty of the latter being to establish general policies and to coordinate the efforts and duties of the regional directors"; and in connection with such a program, the establishment of "regional stations, virtually universities of soil fertility and fertilizer research, with every facility in the way of laboratory buildings, greenhouses, and fields to permit the most advanced scientific study of fundamental factors connected with soil fertility, fertilizer, and plant nutrition investigations where station and Department scientists could work in cooperation on such research."

Needless to say, this program contains many novel and far-reaching features, and as Dr. Knight himself concludes "may now seem Utopian in scope and purpose." He maintains, however, that it would "serve the interests of the Nation as a whole, and properly organized would not tend to supplant in any measure the important and highly essential experimental work of the experiment stations, but instead should expand their usefulness to our national agricultural industry."

Attendance on the conference approximated 150 men and women, exclusive of the Pennsylvania College and Station staffs. The Northeastern States, Ohio, and Georgia were strongly represented, and from 1 to 5 persons were enrolled from California, Illinois, Indiana, Iowa, Michigan, West Virginia, Quebec, Germany, and India. The delegation from the United States Department of Agriculture included the chief and others from the Bureau of Chemistry and Soils and representatives from the Bureau of Plant Industry, the Office of Cooperative Extension Work, and the Office of Experiment Stations. While the greater number of those present are directly engaged in agronomic work, the delegations from the experiment stations of Massachusetts, Rhode Island, New Jersey, and Maryland were headed by their directors, and there were not a few whose interest was primarily in the historical aspects of the occasion.

Thus, from many standpoints it appears that the Soil Fertility Conference developed much that was of significance and value. It brought together a goodly proportion of the soil specialists of the

country for a detailed consideration of what had been learned in a half century of continuous field experiments and indicated what may fairly be expected to result from this and related lines of inquiry. In this respect it may be compared with the somewhat analogous service rendered by the course of lectures given in this country in 1893 by Sir Joseph Gilbert on the 50 years' investigations at Rothamsted. In addition, as the celebration of the semicentennial of an important event in experiment station history, it was both novel and worth while, happily conceived and adequately handled, and without doubt productive of much benefit to the cause of agricultural research as a whole.

OTHER SUMMER MEETINGS OF 1931

Although the summer of 1931 has been somewhat exceptional in the absence from the Western Hemisphere of international gatherings of direct interest to agricultural science such as have been more or less characteristic of recent years, there have been fully the usual number of meetings of national or regional scope. The summer season seems steadily to be gaining in favor as a time for the bringing together of groups of workers either for their annual meetings or in many cases as an addition to these assemblages. So numerous have these gatherings become in fact that of late it has seldom proved practicable for *Experiment Station Record* to be represented at many of these points, but the policy has been maintained of covering as completely as possible those of general interest.

In addition to the Soil Fertility Conference, already discussed, the meetings during the past summer for which reports are available were three in number. These included the twenty-fifth annual meeting of the American Society of Agricultural Engineers at Ames, Iowa, from June 22 to 25, an account of which is reserved for the October number of the *Record;* the twenty-first meeting of the agricultural libraries section of the American Library Association at New Haven, Conn., on June 22, noted on page 400; and the eleventh annual convention of the Canadian Society of Technical Agriculturists at Guelph, Ont., from June 22 to 26.

THE GUELPH MEETING OF THE CANADIAN SOCIETY OF TECHNICAL AGRICULTURISTS

The 1931 convention of the Canadian Society of Technical Agriculturists was the eleventh gathering of a body without precise duplicate in any other country. Organized in 1920, the society has now grown in numbers to a total of nearly 1,300 members, distributed among 9 Provinces and 20 local branches and representative of all phases of technical agriculture. So large a proportion of the leaders of Dominion agriculture with advanced training along these lines is included in its enrollment that the society was referred to by its

president, Mr. W. T. Macoun, horticulturist of the Dominion Department of Agriculture, as "a federation of alumni, linking the men from the various colleges throughout Canada into one strong body capable of great things for the advancement of Canadian agriculture." It is affiliated with the American Association for the Advancement of Science and the British Association and other organizations in Great Britain and elsewhere, but its distinguishing feature lies in its unifying influence and leadership.

The convention followed its usual practice of meeting with some educational institution, most of its events taking place on the campus of the Ontario Agricultural College, but with a field excursion of about 200 miles to Niagara Falls, which gave opportunity to observe the Niagara fruit belt along the southwestern shore of Lake Ontario and to inspect the horticultural experiment station at Vineland. The registration was the largest thus far attained, exceeding 500 persons, and included official delegates and members from every Province in the Dominion and visitors from the British Isles, the Connecticut, Massachusetts, Ohio, and Wisconsin Experiment Stations, and the U. S. Department of Agriculture. Practically every university and scientific institution in the Dominion and each branch of the Dominion Department of Agriculture were represented.

The convention program covered its usual broad field, without attempt at concentration on any single problem or phase of agriculture. One of the distinctive features in recent years has been the provision of what are called "open lectures" interspersed throughout the sessions with a view to acquainting the general public with the existing state of knowledge as to some of the questions of the day. These lectures included a series of two on Animal Nutrition, by Dr. J. B. Orr of the Rowett Research Institute, Aberdeen, Scotland; a discussion of The Present Farm Economics Situation, by Dr. O. C. Stine of the U. S. Department of Agriculture; The Work of the National Research Council of Canada, by its president, Dr. H. M. Tory; Agricultural Development in Soviet Russia and Its Relation to the Wheat Problem, by Dr. J. G. Dickson of the University of Wisconsin; Diagnosing Soil Deficiencies, by Dr. G. N. Hoffer of Lafayette, Ind.; and two lectures entitled Selection in Self-Fertilized Lines Applied to Horticultural Crops and The Efforts of Science to Increase Food Resources, by Dr. D. F. Jones of the Connecticut State Station.

The interests of specialists were cared for in group sessions which included the annual meetings of the Eastern Canada Society of Animal Production, the Canadian Society of Agricultural Economics, the Canadian Phytopathological Society, and the horticultural and soils sections of the society itself. Extension problems were dealt with in the Conference of the Agricultural Rep-

resentatives (county agents) of the Ontario Department of Agriculture, which preceded and ran concurrently with the convention. Field crops activities had been considered earlier at a convention of the Canadian Seed Growers Association held at Kemptville, Ont., from June 17 to 20.

An important phase of the society's activities is cared for by its reports of standing committees on progress, agricultural policies, educational policies, research, and economics and marketing. Of these, the report of the committee on research, headed by Prof. W. H. Brittain of Macdonald College and analogous in some respects to the committee on experiment station organization and policy of the Association of Land-Grant Colleges and Universities, was of special significance. The points under discussion for the current year dealt with a proposed survey of agricultural research projects, the more adequate training, selection, and responsibility of research workers, standardization of methods, the more effective organization of research, and the stimulation of cooperation and coordination. Under the last of these heads, reference was made to the "more or less haphazard and sometimes irresponsible manner in which complicated problems were undertaken. . . . The problems on which they are working originate, for the most part, in the minds of individual workers. Previous to the initiation of the problem there is often no full discussion by all interested parties. There is indicated, therefore, a grave weakness in the method of selecting problems, which frequently results in workers in various fields all claiming that a certain problem is peculiarly their own. The point is made that there should be a better method of selecting problems to be attacked, of deciding who should attempt them and, in general, the scope of the proposed work." The opinion may be hazarded that the difficulty thus set forth is one which is by no means confined to Canadian workers.

Despite the inclusion of numerous speakers from the United States on the society's programs and the notably cordial welcome extended to visitors, it is not unlikely that the proceedings and work of this organization are not as well known in this country as their importance and interest merit. The prevailing policy as to the place of meeting is on a rotational basis between the various sections of Canada, and in not a few cases the conventions are more accessible to workers from some of the neighboring States than are many of the gatherings upon our own soil. Doubtless a larger number than ordinarily cross the border for the purpose would find the sessions both pleasant and profitable. For many others to whom this is impracticable the official publication of the society, *Scientific Agriculture*, may be commended as a convenient means of a better acquaintance which can not fail to be mutually helpful.

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

Handbook of chemical microscopy, II, É. M. CHAMOT and C. W. MASON (*New York: John Wiley & Sons; London: Chapman & Hall, 1931, vol. 2, pp. IX+411, figs. 181*).—This volume takes up the more purely chemical manipulations for which the general microtechnical means are provided by volume 1 (E. S. R., 63, p. 7). It discusses manipulative methods of a general character—handling small amounts of materials; methods of applying reagents in microscopical qualitative analysis; detection in turn of the elements of groups 1 to 8 of the periodic system; the detection of anions; special reagents yielding reactions with a number of cations; and qualitative analysis of material of unknown composition.

Temperature changes in the formation of solutions, K. M. WATSON and O. L. KOWALKE (*Indus. and Engin. Chem., 22 (1930), No. 4, pp. 370–376, figs. 9*).—A method whereby the differential heats of dissolution of a salt at various concentrations and temperatures may be calculated from the thermochemical data generally available was demonstrated. So-called "dissolution charts" from which the temperature attained in the adiabatic formation of solutions may be readily predicted are presented, together with some data bearing on the equilibrium temperatures attained by the solid particles of a typical salt when dissolving in water.

American cherry kernel oil, G. S. JAMIESON and S. I. GERTLER (*Oil and Fat Indus., 7 (1930), No. 10, pp. 371, 372, 387*).—The fatty acid constituents of the oil commercially prepared from the kernels of the seeds separated from the fruit in the canning of sour cherries were examined by the U. S. D. A. Bureau of Chemistry and Soils. "The oil is being used in the manufacture of various cosmetics, for some pharmaceutical preparations, and as a salad oil, for which purposes it appears to be well adapted." Full data with respect both to fatty acid content and to the oil constants usually determined are given, and the following summary statement of results is made:

"The oil contains 87 per cent of unsaturated acids and 7.7 of saturated acids. The saturated acids consist chiefly of palmitic and stearic acids, along with small quantities of arachidic and myristic acids, whereas the unsaturated fraction consists of oleic and linolic acids. The refined oil, after being held for more than a year, was found to be in excellent condition, indicating that it has good keeping qualities. The results of the investigation made on cherry kernel oil indicate that it should prove useful as a high-grade salad oil, and because of its similarity to almond oil it should be suitable for use in the manufacture of cosmetics."

Autoxidation of corn oil as related to its unsaponifiable constituents, H. A. MATTILL and B. CRAWFORD (*Indus. and Engin. Chem., 22 (1930), No. 4, pp. 341–344*).—The keeping qualities of fats and oils were found at the Iowa State University to depend primarily "upon the relative proportions of 'prooxidants' and 'antioxidants' which they contain. Heat-treated oils often

show a much shorter induction period than untreated oils. Observations on corn oil in various stages of preparation relate the antioxidizing sterols and the products of heat treatment with susceptibility to oxidation."

The amino-acids of flesh, III–V (*Biochem. Jour.*, *23* (*1929*), *No. 2*, *pp. 161–165*; *24* (*1930*), *No. 5*, *pp. 1294–1300*).— These papers continue the work already noted (E. S. R., 61, p. 306).

III. *The diamino-acid content of fish*, J. L. Rosedale (pp. 161–165).—The diamino acid content of the flesh of the species *Lutianus roseus*, *Caranx rottleri*, *Thynnus* sp., *Polynemus indicus*, *P. tetradactylus*, and *Thynnicthys* (two species), was determined, mainly by the Van Slyke method (E. S. R., 26, p. 22). "The value for diamino acid nitrogen in the flesh muscles of fish appears to be higher than that previously obtained for mammalian tissues. This seems to be due mainly to an increased amount of histidine nitrogen. Some evidence is brought forward showing that incomplete hydrolysis leads to error in the Van Slyke analysis. Different tissues appear to require different lengths of time to insure complete hydrolysis with 25 per cent HCl. In the separation of histidine and arginine as silver salts, it appears that unless the mixture is kept slightly acid there is a danger of precipitating some of the arginine together with the histidine."

IV. *The diamino-acid content of muscle tissue of different classes of animals*, J. L. Rosedale and J. P. Morris (pp. 1294–1296).—"Tissues of the crocodile, cockroach, mosquito larvae (*A. ludlowi*), oysters, and sponge (monaxonid), have been analyzed by Van Slyke's method. An increase in the amount of histidine nitrogen and a decrease of lysine nitrogen is found in the lower organisms."

V. *Monoamino-acids of the horse mackerel* (*Caranx rottleri*), J. L. Rosedale and C. J. Oliveiro (pp. 1297–1300).—"The monoamino acids of the horse mackerel (*C. rottleri*) have been extracted by butyl alcohol [using the Dakin method (E. S. R., 40, p. 611)]. It is considered that greater ease in this extraction is secured if certain amino acids are first removed from the solution, and a process involving but slight loss of nitrogen is described."

The behaviour of glutathione in yeast, N. U. Meldrum (*Biochem. Jour.*, *24* (*1930*), *No. 5*, *pp. 1421–1427*).—It is concluded that "the respiration of yeast may be reduced by 60 per cent to 90 per cent (*a*) by narcotics, which inhibit the reducing systems, (*b*) by cyanide, which prevents the indophenol oxidase from oxidizing cytochrome, without the amount of reduced glutathione being affected. Cooling has likewise no effect, though this is known to retard the dehydrogenases more than the indophenol oxidase. Glutathione does not reduce cytochrome in yeast. No evidence could be found that dehydrogenases reduce glutathione with simultaneous oxidation of their substrates, and it seems unlikely that glutathione is in any way concerned with the cytochrome-indophenol oxidase system. Yeast may be starved till its rate of respiration falls to about 5 per cent of that in glucose solution without affecting the thiol content. No evidence has been obtained that glutathione is directly concerned in carbohydrate oxidation by yeast."

The enzymic synthesis of raffinose, A. V. Blagoveschenski (*Biochem. Jour.*, *24* (*1930*), *No. 5*, *pp. 1337–1339*).—The existence of an equilibrium short of the point of complete hydrolysis in the action of emulsin or raffinose led the author to suspect a reverse reaction, condensing sucrose and galactose to form raffinose. The results of experiments carried out in aqueous solution were in all cases negative, and 80 per cent acetone was accordingly substituted for water as a reaction medium. Prolonged exposures (up to 5 months at 35° C.) of the mixture of sucrose and galactose in 80 per cent acetone solution to the action of suspended emulsin gave small yields of crystalline substance approxi-

mating the optical properties of raffinose much more closely than those either of sucrose or of galactose. The action of emulsin upon the raffinose-like substance, under conditions favoring hydrolysis, yielded sucrose and galactose. "These results give us the right to conclude that the action of emulsin on a solution of galactose and sucrose in 80 per cent acetone produces a compound with the properties of raffinose."

The mode of action of tyrosinase, C. E. M. Pugh (*Biochem. Jour.*, *24* (*1930*), *No. 5*, *pp. 1442–1455*).—Negative results are reported in attempts to separate tyrosinase preparations into two enzymes and to separate tyrosinase into enzyme proper and a coenzyme.

With respect to the properties and activities of tyrosinase in relation to various substrates, it was found that "moderate heating, or storage, of certain tyrosinase preparations increases their activity on monohydric relative to *o*-dihydric phenols. Cyanide or sulfite has the contrary effect. The action of tyrosinase on monohydric phenols is hastened by water containing homoquinone. The action of tyrosinase on monohydric phenols is hastened by hydrogen peroxide in small concentration. Slight initial activation of action on *o*-dihydric phenol has also been observed; its cause is uncertain. There is no evidence that tyrosinase alone in presence of molecular oxygen is not able to oxidize monohydric phenols. The initial acceleration of the action of tyrosinase on monohydric phenols by traces of *o*-dihydric phenols appears to be due to peroxide formation, either hydrogen peroxide or both hydrogen peroxide and orthoquinone being responsible."

The antineuritic vitamin: Preliminary report [trans. title], A. G. van Veen (*Rec. Trav. Chim. Pays-Bas*, *49* (*1930*), *No. 12*, *pp. 1178*, *1179*).—It is noted briefly that by preliminary treatment of yeast or rice bran extracts with aromatic chlorides or sulfonyl chlorides, followed by precipitation as the double salt with platinum or cadmium chloride, the antineuritic vitamin can be obtained readily in a crystalline although not absolutely pure form. The yield from 75 kg. of rice bran was about 140 mg. of a crystalline product which could be still further purified by recrystallization. The product thus obtained gave only a very faint Pauly reaction, and this became still more faint with repeated crystallization.

A study of the effect of nitrous acid upon components of the vitamin B complex, H. C. Sherman and M. L. Whitsitt (*Jour. Biol. Chem.*, *90* (*1931*), *No. 1*, *pp. 153–160*).—The apparently conflicting findings in previous investigations of the effect of nitrous acid upon the vitamin B complex and its components vitamins B (B_1) and G (B_2) are reviewed, and experiments are reported which were undertaken to throw further light upon the differentiation of vitamins B and G by means of strictly parallel measurements of the effects of nitrous acid upon these two factors in the same solution.

As the material to be tested, protein-free milk was prepared as follows: Five hundred gm. of skim milk powder was mixed with 4,000 cc. of distilled water, 890 cc. of 1 per cent hydrochloric acid was stirred in, and the coagulated casein was removed by pouring the mixture through cheesecloth. The filtrate was boiled 5 minutes to precipitate the lactalbumin, filtered, and the filtrate neutralized to pH 5.7 by M/50 sodium hydroxide. This solution was treated with nitrous acid in two ways, (1) by aspiration from a nitrous acid generator and (2) by direct generation in the vitamin solution. Since the latter material was not readily taken by the animals, additional experiments were conducted in which in one case the daily portions were fed by hand to secure complete consumption and in the other the nitrous acid treatment was only one-fourth as drastic.

The results obtained indicated that treatment by the aspiration method had little if any destructive effect upon vitamin B. Drastic treatment resulted in a decided loss in vitamin B, as determined both by the weight curves of the experimental animals and by the development of polyneuritic symptoms. The less drastic treatment gave intermediate results.

In the vitamin G experiments no destruction of the vitamin took place in the treatment by aspiration. In the solutions in which nitrous acid was generated directly there was no loss in potency as determined by a 4 weeks' feeding period, but partial destruction as determined by an 8 weeks' feeding period.

In the light of recent suggestions of hitherto unknown factors in the vitamin B complex, these findings are thought to indicate more or less destruction of one of the newer factors rather than of vitamin G. It is suggested moreover that the reaction involved may be one of oxidation rather than deaminization. "Our results as a whole appear to be in harmony with the view of Salmon and his coworkers [E. S. R., 61, p. 91] that vitamin B behaves in vitro more like a nitrogenous base and vitamin G more like a neutral organic substance."

A total carbon procedure, E. Winters and D. C. Wimer (*Jour. Amer. Soc. Agron., 23 (1931), No. 4, pp. 280–285, fig. 1*).—The procedure described in this contribution from the Illinois Experiment Station is a modification of the combustion method, in which the principal improvement consists in the device of an electromagnetic means for moving the boat containing the sample from the cooled to the heated portion of the tube after all connections have been made and the tube closed. This change permitted a further time saving, in that it was found no longer necessary to cool the tube between successive determinations. Closely agreeing results are shown.

A method of oxidizing and dissolving soil for the determination of total and filterable manganese and phosphorus, E. M. Emmert (*Soil Sci., 31 (1931), No. 3, pp. 175–182*).—The method here given for the preparation of solutions of the soil minerals for determinations of total and filtrable manganese and phosphorus was found at the Kentucky Experiment Station to be simpler than the Official methods, and "the colorimetric analyses used enable greater accuracy on small quantities of the elements than the older standard methods."

In part, the modified procedure was as follows: To 1 gm. of finely pulverized soil (50 mesh or finer) add 2 gm. of sodium chlorate in a dry 500-cc. Kjeldahl flask, and wash down the sides of the flask with 25 cc. of aqueous sulfuric acid, 50 per cent by volume. Heat with a free flame, adjusted to full height in order to heat the air above the solution enough more rapidly than the solution itself to prevent the accumulation and explosion of chlorine peroxide. After green fumes cease forming and the reaction is no longer violent, heat strongly to the appearance of sulfuric acid fumes. "If the residue and solution are not free of organic matter add more chlorate in small portions at a time until the solution clears." After clearing, cool, add 75 cc. of water, shake well, and make up to exactly 100 cc.

Aliquots from the sample solution thus prepared were used for determinations of manganese, according to the method of Willard and Greathouse (E. S. R., 38, p. 204), and for phosphorus determinations by a somewhat modified form of the Fiske-Subbarow procedure.

For the so-called filtrable manganese and phosphorus procedure, treatment of the filtrates was the same as that above outlined for the whole soil. It is stated that the procedure described is simpler than are the usual methods and that the danger of loss "may be less."

On the question of the quantitative determination of iron in organs and body fluids [trans. title], H. Hoesters (*Biochem. Ztschr., 232*

(1931), No. 4–6, pp. 469–478).—Organic matter was oxidized by a procedure attributed to Neumann and described as heating in the usual way with nitric and sulfuric acids, with the final addition of hydrogen peroxide. Oxides of nitrogen remaining in the solution of the oxidized material were decomposed by means of urea. The solution was then made up with distilled water to 50 cc. For each 2 mg. of iron in the sample solution were then added 10 cc. of a solution made up by dissolving separately 25 gm. of zinc sulfate and 100 gm. of sodium phosphate in iron-free distilled water, mixing the solutions in a 1-liter flask, bringing the precipitate just into solution by means of sulfuric acid of the highest purity, and making up the volume of the reagent to 1 liter. Following the precipitation of the zinc phosphate-ferric oxide double compound by the further addition of ammonia, the precipitate was again dissolved by adding ammonia just sufficient to take it up. The clear solution was then heated for from 30 to 60 minutes at the boiling point. The precipitate thus formed was filtered hot and washed with hot water. The necessity of iron-free filter paper is specially emphasized. The precipitate was redissolved in a definitely measured volume of about 5 cc. of the purest available hydrochloric acid, and the solution washed out of the paper, the total volume of the filtrate being kept below 20 cc. Repeating the precipitation was found to effect a further purification when this was needed.

The hydrochloric acid solution of the iron precipitate was transferred to a 50-cc. volumetric flask and made up to volume with a 40 per cent solution of ammonium thiocyanate, and colorimetric comparison was made after three minutes with a standard solution consisting of ferric chloride and ammonium thiocyanate. It is noted that the standard solution should be replaced by a freshly made one after 20 minutes at the most. With 0.01 mg. of iron in 100 cc. of solution the error was +4 per cent of the total iron present; with 0.1 mg. of iron in the same sample volume the error found was —0.9 per cent.

The spectrophotometric microdetermination of phosphorus [trans. title], T. Teorell (*Biochem. Ztschr., 230 (1931), No. 1–3, pp. 1–9*).—In a spectrophotometric examination of the color developed in the Fiske-Subbarow form of the ceruleomolybdate method for the colorimetric determination of phosphate, the author found a remarkably close proportionality between phosphate content and extinction coefficient. Having slightly modified the procedure to adapt it to the change from colorimetric to spectrophotometric color estimation, he found it possible to carry out the determination without a comparison standard and to obtain an accuracy of ±2 per cent, approximately, in the determination of from 0.01 to 0.05 mg. of phosphorus, even in organic substances. The working details of the new procedure are stated in full, illustrative results with lecithin, a nucleoprotein, a lipoid extract from blood, etc., are given, and the effects of varying the proportionate quantity of the reagent and some similar variations in procedure are briefly considered.

The effect of nitrites, thiocyanates, and some organic substances on the iodine-starch reaction [trans. title], Z. Ernst (*Biochem. Ztschr., 232 (1931), No. 4–6, pp. 346–351*).—The iodine test, consisting of the treatment of the substance to be tested with starch solution and acidified nitrite, was found much more sensitive in saliva than in purely aqueous solutions, a phenomenon attributed to the thiocyanate content of the saliva. It is stated, further, that the starch-iodine reaction in acid solution was interfered with by the nitrite, and that this interfering action of the nitrite was inhibited by the thiocyanate. Uric acid and peptone showed an action similar to that of the thiocyanate, and in lesser degree leucine, trypsin, and serum albumin had a like effect in increasing the sensitiveness of the test.

The determination of cellulose in straws, S. H. Jenkins (*Biochem. Jour., 24 (1930), No. 5, pp. 1428–1432*).—This contribution from the Rothamsted Experimental Station presents a method consisting, in principle, in the modification of the standard chlorination procedure of Cross and Bevan (E. S. R., 28, p. 805. The author states that while the standard method is the most reliable it has "three disadvantages, which are (1) the inconvenience of working with gaseous chlorine, (2) the lengthy extraction with sodium sulfite solution which is required to remove the lignone chloride, and (3) the difficulty of chlorinating a number of samples simultaneously"; and he finds that a cold 15 per cent solution of sodium hypochlorite can be made to serve the purpose of the gaseous chlorine of the Cross and Bevan method, so that "the cellulose in straw is readily determined by treating the straw with hot dilute alkali and acid and then with cold hypochlorite solution." Further observations are thus stated:

"The product obtained is practically identical in character with the Cross and Bevan chlorination product, except that it contains slightly less xylan than the latter. When due allowance is made for the xylan present the percentage of pure cellulose found in a straw is the same by the Cross and Bevan and the hypochlorite method. The treatment referred to . . . has a negligible effect on pure cellulose. The hypochlorite method of chlorinating has the following points in its favor: From 12 to 16 cellulose determinations can be carried out in a day by one worker. Large scale preparations of straw cellulose are possible without inconvenience. The cellulose can be prepared in quantitative yield."

For the isolation of straw cellulose in experimental quantities "very little modification of the proportions of the reagents used in the estimation is required," the report of this process being that "178.5 gm. of dry straw were mixed with 7 liters of boiling water containing 100 cc. of concentrated HCl and left in a boiling water bath for 10 minutes. The mixture was then strained through a cloth and the residual straw added to 7 liters of boiling water containing 15 gm. of NaOH. After standing in the boiling water bath for 10 minutes, the aqueous portion was poured off through a cloth and then chlorinated for 20 minutes with 200 cc. of 15 per cent NaOCl. The straw was filtered off, washed, and again chlorinated with the same quantity of hypochlorite. After washing the cellulose first with cold, then with hot water, it was washed with 2 liters of 0.5 per cent hydrogen peroxide. The use of hydrogen peroxide insures complete decomposition of the hypochlorite. Finally the cellulose was washed free from hydrogen peroxide with cold and hot water. In this manner 93 gm. of cellulose were obtained, equivalent to a 52.1 per cent yield on the weight of straw taken. An analysis of the sample of oat straw showed that it contained 52.2 per cent of cellulose, which gave a furfuraldehyde yield of 11.1 per cent." The small scale, quantitative procedure is also detailed.

An improved method for the determination of iodine in blood, H. A. A. Aitken (*Biochem. Jour., 24 (1930), No. 5, pp. 1456–1459, fig. 1*).—Report is made of a modification of the titrimetric estimation based on the iodide-iodate reaction. The new details consist principally in the use of vessels and a slightly modified technic designed to permit of an estimation in a sample volume of 0.2 cc. instead of the 2-cc. volume more commonly used.

The analysis of drugs and chemicals, N. Evers and G. D. Elsdon (*London: Charles Griffin & Co., 1929, pp. X+372, figs. 19*).—The authors note that "in the past, the analysis of drugs has generally been treated in English textbooks as an adjunct to food analysis, usually from the point of view of the Foods and Drugs Acts, and in a more or less incomplete manner," and offer the pres-

ent work as a more complete treatment from the viewpoint of the general analyst. The contents include inorganic drugs and chemicals; organic chemicals; crude drugs; galenicals; fixed oils, fats, and waxes; and essential oils.

Utilization of onions by canning, C. R. Fellers (*Massachusetts Sta. Bul. 271 (1931), p. 267*).—Continued tests (E. S. R., 63, p. 507) on dehydrated cull onions and the ease of manufacture of onion powder or "flavor" have renewed confidence in the feasibility of utilizing cull onions in this way. Preliminary experiments on preserving small onions in brine for pickling purposes indicate that a 60° salometer brine is preferable to lighter brines.

METEOROLOGY

The literature of climatology, R. DeC. Ward (*Ann. Assoc. Amer. Geogr., 21 (1931), No. 1, pp. 34–51*).—This is a brief survey of the literature of climatology under the following heads: Tabulated numerical data; climatography, or descriptive climatology; general climatology; human climatology—climate and man; medical climatology; botanical or agricultural climatology; changes of climate; atlases; and bibliographies, indicating "in a very general way . . . the main lines along which climatological investigation and writing has progressed."

With regard to agricultural climatology, the author says: "The importance of climate in relation to crops has naturally led to innumerable investigations along this line of research. Botanical, geographical, and meteorological journals and miscellaneous publications contain a vast store of information on this subject. But it deals mostly with limited aspects of the larger field, such as the effect of one season's weather upon the yield of one crop, or the climatic controls over the distribution of crops in one district or political division." Noting some of the major contributions in this field, the author expresses the view that the subject "deserves further active study on the part of botanists and climatologists."

Dry climates of the United States.—I, Climatic map, R. J. Russell (*Calif. Univ. Pubs. Geogr., 5 (1931), No. 1, pp. 41, pl. 1, figs. 8*).—A map covering the western half of the United States, "constructed strictly in accordance with Köppen's definitions [E. S. R., 50, p. 807], weighed against a background of personal acquaintance with the areas involved, as well as against descriptions and maps published by others, and [with] such modifications as have appeared desirable," is given, and its method of preparation and significance, especially with reference to distribution of native vegetation and cultivated crops, are discussed.

The results of the author's studies in connection with the preparation of this map "substantiate the findings of McDougall [E. S. R., 54, p. 209] in regard to areal distribution of seasonal precipitation. Both show a main belt of uniform distribution following the Rocky Mountains, but in the South swinging west into Arizona. Both indicate a second area of uniform distribution toward the Texas coast."

Attention is called to the significant fact that as regards temperature the boundary lines of the climatic areas agree more closely with the distributional limits of cultivated crops than with those of native vegetation, especially with respect to the humid region. "Baker's Spring Wheat Belt, Corn Belt, and Hay and Pasture Region are, for all practical purposes, limited southward by January 32° F. This line is the northern limit of the Corn and the Winter Wheat Belt. . . .

"In general, it may be noticed that cultural landscapes of the North Central States differ quite noticeably from those of the South Central States, and

that if a boundary between the two is drawn it will not depart widely from the courses of the Ohio and Missouri Rivers. . . . Cultural landscapes differ from natural landscapes far less in the dry than in the humid parts of the United States. . . .

"Overgrazing produces conspicuous changes, but apparently these have little or no bearing on the selection of a line between hot and cold types of dry climate. Truck gardens, date culture, citrus fruits, cotton, grain sorghums, and other crops are characteristic of the hot, dry climate, whereas rye, wheat, and other crops are chiefly restricted to the cold region; but the areas of agricultural development, chiefly determined by edaphic factors, are so small and widely spaced that they do not furnish much in the way of data for climatic mapping."

It is stated that the use of the January isotherm of 32° for differentiating between hot and cold types of climates "appears to fit facts of landscape better than does any of the other lines proposed, and it appears to be an expression of fundamental processes in landscape evolution."

Soil temperatures in the United States, E. M. Fitton and C. F. Brooks (*U. S. Mo. Weather Rev., 59 (1931), No. 1, pp. 6–16, figs. 7*).—Data reported by 32 experiment stations and from other sources are summarized, from which the following conclusions are drawn: "(1) Air and soil temperatures near the surface vary in a fairly parallel manner. . . . (2) The soil temperatures at slight depths are generally higher than the air temperatures throughout the year. . . . (3) The diurnal range in soil temperatures extends to a depth of about 3 ft. . . . (4) The annual range in soil temperature is quite apparent at a depth of 10 ft., the greatest depth for which a record is obtainable in the United States. . . . (5) The lag of maximum and minimum soil temperatures increases with depth. . . . (6) A cover crop lessens the diurnal and annual temperature ranges. . . . (7) In the wintertime, northerly stations where the snow cover is more or less permanent show higher mean monthly soil temperatures than stations somewhat farther south or west but lacking a good snow cover. . . . (8) The presence of moisture in the soil tends to give a low and uniform temperature. . . . (9) Loam, clay, and peat soils never become as warm in summer as the drier gravel and sand soils. . . . (10) Soil temperature and its annual range decreases with altitude. . . . (11) South exposures at any altitude have higher temperatures and a greater range than north exposures."

A list of 60 references to literature cited is given.

Climatological data for the United States by sections, [1930] (*U. S. Dept. Agr., Weather Bur. Climat. Data, 17 (1930), No. 13, pp. [249], pls. 6, figs. 27*).—Summaries are given of climatological data for each month of 1930 and for the year as a whole for each State.

Monthly Weather Review, [January–February, 1931] (*U. S. Mo. Weather Rev., 59 (1931), Nos. 1, pp. 55, pls. 16, figs. 19; 2, pp. 57–96, pls. 17, figs. 26*).—In addition to detailed summaries of meteorological and climatological data and weather conditions for January and February, 1931, solar and aerological observations, and bibliographical and other information, these numbers contain the following contributions:

No. 1.—The Evolution of Meteorological Institutions in the United States, by E. R. Miller (pp. 1–6); Soil Temperatures in the United States (illus.), by E. M. Fitton and C. F. Brooks (pp. 6–16) (see above); Resolutions Passed by the Polar Year Commission of the International Meteorological Committee at Leningrad, August, 1930, by J. A. Fleming and W. J. Peters (pp. 17, 18); Climatological Charts for the Allegheny Forest Region (illus.), by H. F. Morey

(pp. 18–28); The Flow of the Dnieper River (illus.), by A. Streiff (pp. 29, 30); Sandstorms in Texas (illus.), by J. A. Riley (pp. 30, 31); The Forest Fire-Weather Service in the Lake States, by J. R. Lloyd (pp. 31–33); Airplane Landings in Gusty Surface Winds, by P. A. Miller (pp. 33, 34); Relations between Winter Temperature and Precipitation (illus.), by T. A. Blair (pp. 34, 35); Interpolation of Rainfall Data by the Method of Correlation, by E. R. Miller (pp. 35, 36); and Smoothed Monthly Means of Sun-Spot Relative Numbers, 1920–1929, Inclusive (illus.), by W. Brunner (p. 37).

No. 2.—A Preliminary Meteorological Survey for Airship Bases on the Middle Atlantic Seaboard (illus.), by W. T. Van Orman (pp. 57–64); New Light on the Beginnings of the Weather Bureau from the Papers of Increase A. Lapham, by E. R. Miller (pp. 65–70); Antarctic Meteorology, by H. T. Harrison (pp. 70–73); Report of the Stream-Flow Prediction Subcommittee (illus.), by A. Streiff (pp. 73, 74); A Method of Determining the Altitude in the Atmosphere above Sea Level where the Freezing Point of Water Occurs (illus.), by J. F. Brennan (p. 75); Sounding-Balloon Releasing Device (illus.), by L. T. Samuels (p. 76); Pyranometer Records Assist in Distinguishing between Haze and Clouds (illus.), by A. F. Gorton and S. W. Chambers (pp. 76, 77); Some Characteristics of Continuous Records of the Total Solar Radiation (Direct+Diffuse) Received on a Horizontal Surface, by H. H. Kimball (p. 77); Comparison of Roof and Ground Exposure of Thermometers, by B. R. Laskowski (pp. 77–79); Further Notes on the Effect of Weather on Apple Yields (illus.), by W. A. Mattice (pp. 79, 80); Effect of Ozone on the Temperature of the Upper Air (illus), by E. H. Gowan (pp. 80, 81); and Prediction of Seasonal Precipitation in California, by J. M. Jones (p. 82).

SOILS—FERTILIZERS

Soil management, F. E. Bear (*New York: John Wiley & Sons; London: Chapman & Hall, 1931, 2. ed., rev. and enl., pp. V+412, [pl. 1], figs. [57]*).—This second printing of the second edition (E. S. R., 57, p. 812), while not altered in form from the first printing of the second edition, contains some changes and additions to the data, bringing the work more completely up to date. The contents are as follows: Factors affecting crop growth, nitrogen and mineral requirements of crops, water requirements of crops, origin and classification of soils, chemical composition of soils, some biological processes in soils, some physical properties of soils, the water in soils, the air in soils, the soil solution, the control of soil water, the mechanical improvement of soils, supplying organic matter, rotating crops, nitrogen economy in soils, mineral economy in soils, limestone economy in soils, the livestock system of farming, soil sanitation, controlling the soil reaction, nitrogen fertilizers, phosphoric acid fertilizers, potash fertilizers, mixed fertilizers, the selection of fertilizers, and the application of fertilizers.

[Soil fertility researches of the Massachusetts Station] (*Massachusetts Sta. Bul. 271 (1931), pp. 240, 247, 248, 270, 271*).—The report includes brief notes on several phases of the soil fertility problem.

Nitrogen fixation in relation to leguminous crops, J. E. Fuller.—Continuing work already published (E. S. R., 64, p. 18), it is observed that the data suggest that the quantity of lime applied, as well as the extent to which acidity is neutralized, may be related to Azotobacter metabolism. Regarding the distribution of cellulose-decomposing activity in the soil of the experimental field, "the data at present appear to correlate the nitrogen-fixing activity of the soil from the different plats of the field."

The effect of decomposing paper on plant growth, L. H. JONES.—Nitrogen deficiency was shown to result either from the decomposition of paper incorporated into the soil or from that of the substance of inadequately waterproofed paper pots. "When paper mulch is incorporated in a soil, nitrogen starvation may ensue unless an available form of nitrogen is supplied to the plant." In the case of tomato seedlings used as test plants "in 4-in. pots with and without paper mulch in the soil, it was noted that all plants made equally good growth for one month. At the end of the second month, the plants in the soil containing no mulch were 38 per cent taller than plants in a soil with mulch, and averaged nine axillary shoots. The plants in the soil containing mulch were without axillary shoots and were more yellow in color, indicating a lack of nitrogen due to decomposing cellulose.

"The problem of obtaining good plants from paper pots is not one of soil acidity nor lack of porosity. . . . When plants become yellow in paper pots they can be made to resume normal growth by an application of sodium nitrate. If the fibers in the paper pot are so protected that decay is impossible, plants equal to those grown in porous clay pots may be grown in these pots."

The effect of temperature on the nitrate content of the soil and plant growth in the presence of decomposing cellulose, L. H. JONES and J. E. FULLER.—"One per cent of cellulose in a soil maintained at constant temperatures ranging from 7 to 35° C. definitely affected the nitrate content of the soil. The tomato, because of its upright habit, was employed as an indicator plant.

"If the soil is one with a high level of fertility, the plants are unaffected by the reduction in nitrates and the differences obtained in plant growth were directly the result of temperature, a marked increase in growth occurring at a temperature of 22° and above. However, if the soil had a low level of fertility, temperature ceased to affect plant growth and the response of the plant was dependent upon the available nitrogen." The presence of decomposing cellulose in such a soil reduced the dry weight of the plants by as much as from one-half to two-thirds of the weight of plants grown in a soil to which no cellulose had been added. In the case of a soil rich in nitrogen the addition of cellulose caused a considerable depletion of nitrates at the lower temperatures, while at higher temperatures nitrification was sufficiently active to replace the nitrate used by the cellulose decomposing organisms. In a poor soil to which a considerable amount of cellulose had been added the ratio of nitrate to cellulose "appears to have been so small that temperature had little influence on the degree of nitrate depletion, the rate of nitrification, or the response of the indicator plant."

Nitrogen fixation in the presence of or as a result of the growth of legumes v. nonlegumes under certain defined agronomic conditions, F. W. MORSE.—The yields from 1924 to 1930, inclusive, from plats of a continued experiment of which the 1929 results have been noted (E. S. R., 63, p. 514), are here tabulated under the headings of leguminous crops grown in rotation and nonleguminous crops grown continuously. Grass, corn, and Japanese millet have gained in production and yield of nitrogen in the absence of nitrogen treatment.

Secular and seasonal changes in soils, J. S. BURD and J. C. MARTIN (*Hilgardia [California Sta.], 5 (1931), No. 15, pp. 455–509, figs. 5*).—The paper here noted covers a "systematic study of 13 soils continuously maintained under controlled conditions for a period of 11 years," special attention having been given to the effect upon the soil of continuous cropping and of prolonged fallowing, followed by a period of continuous cropping.

It was found that the declines in yield and the period of the decline characteristic of continuous cropping are "of the same order in soils the productive

capacity of which had been enhanced by prolonged fallowing as in those which had not been so treated. 'Heavy' soils are not necessarily more productive than 'light' soils, but they tend to decline less rapidly in crop-producing capacity. The less productive soils give a relatively greater response to fallowing than do the more productive ones. In soils which are cultivated and kept at 'optimum' moisture throughout the year, the mean annual loss of nitrogen from the soil (other than the nitrogen removed by crops) appears to be little greater and is frequently somewhat less in cropped than in fallowed soils. If water is withheld between seasons from continuously cropped soils which are on a low scale of production, further losses of nitrogen appear to be inconsiderable and gains may occur. If water is withheld and the soils are not cultivated, fallowed soils tend to increase in total nitrogen content as well as in nitrate by significant, and in many soils by substantial, amounts. The ratio of carbon to nitrogen tends to be the same in continuously cropped soils as in soils which have been fallowed for a prolonged period and then cropped for several years."

A general discussion (a) of the limitations which must be placed on the interpretation of data obtained from studies of the liquid phase, (b) of the mechanism by which solutes enter the liquid phase, and (c) of the significance of phosphate and potassium in the liquid phase is presented, together with some observations on the relation between displaced solutions and water extracts. "The total concentration of the liquid phase is invariably decreased as a result of cropping and is usually, but not invariably, increased by fallowing. The sulfate concentration tends to increase in both cropped and fallowed soils. This tendency usually results in increased concentrations of sulfate in spite of plant absorption of this ion from cropped soils. Nitrates invariably decline in cropped soils and usually increase substantially in fallowed soils. Increases in sulfate and declines in nitrate in cropped soils thus change the general character of the liquid phase and must affect the rate of absorption by the plant of cations in equilibrium with these anions. A significant decline in potassium concentration in a relatively short period is observed in many cropped soils. In soils depleted as a result of cropping there is a seasonal decline in total concentration, followed by a recovery which may be fairly rapid after the plants have ceased to absorb from the soil. Whatever their previous history, cropped soils lose more nitrate than is accounted for by the crops' absorption, the absolute losses being enormous in soils containing large amounts of nitrate. If soils are cropped after prolonged fallowing there is a very rapid decline in total concentration, accompanied by a decline in crop yields."

The podsolic process in soils, T. J. Dunnewald (*Jour. Amer. Soc. Agron., 23 (1931), No. 4, pp. 259–265*).—The author of this contribution from the Wyoming Experiment Station states his principal conclusions in the following terms:

"The method used failed to show that organic matter leaching explains the accumulation of silica in the surface horizons of podsolic soils. The removal of iron and alumina from the surface horizons and their reabsorption in the subsoil are shown in the acid horizons of three of the soils used. The rapid removal of bases from timbered soil as compared to grass soil is shown, and the slower removal of sesquioxide as compared to the rapid removal of bases is brought out. Available phosphorus seems to be lost more rapidly into the subsoil of grass soils than is the case with timbered soils. If this method parallels natural processes, it is necessary to conclude that organic matter is not concerned in the podsolic accumulation of silica but is concerned in the translocation of bases and sesquioxides. Extraction of the bases and

formation of acid conditions appear to be a necessary preliminary to the deposition of iron and alumina in the subsoil. The bases are removed from the surface soil about 20 times as fast as the sesquioxides under the same conditions."

Some characteristics of an eroded soil, G. W. MUSGRAVE and H. DUNLAVY (*Jour. Amer. Soc. Agron., 23 (1931), No. 4, pp. 245–252, figs. 2*).—In a study of a specific case of soil erosion accompanying continuous cotton growing at the Texas Experiment Station in cooperation with the U. S. D. A. Bureau of Chemistry and Soils, "the soil profile has been measured and shows the loss of surface soil which has occurred in increasing amount down the 1 per cent slope. Cotton yields as measured by check rows located every third row showed a definite downward trend as erosion progressed. Soil moisture determinations and measurements of the relative water-holding capacity of the soil likewise showed a downward trend. A physical study of the soil across the area indicated the following: Loss of organic matter, decline in amount of colloids, decline in moisture equivalent, and lower percentage of clay on the eroded than on the uneroded portions of the slope."

An extension program for the control of soil erosion in Nebraska, P. H. STEWART (*Jour. Amer. Soc. Agron., 23 (1931), No. 4, pp. 253–258*).—"The loss of organic matter through the removal of the surface soil by sheet erosion is the most important damage to Nebraska land by soil washing, although other losses are important. The use of legume crops to maintain the organic matter content of the soil is emphasized for Nebraska conditions. The most important methods used in carrying on the erosion control programs include circular letters, schoolhouse meetings, publicity, soil robber trials, soil service meetings, corn yield contests, detailed surveys of definite areas, and result demonstrations of definite practices, such as installing brush and soil-saving dams, terracing, and carrying out definite rotation practices."

The national program of soil and water conservation, H. H. BENNETT (*Jour. Amer. Soc. Agron., 23 (1931), No. 5, pp. 357–371, fig. 1*).—This contribution from the U. S. D. A. Bureau of Chemistry and Soils presents a general view of the problem of erosion and run-off losses, with an outline sketch of the present plan for a nation-wide attack upon the problem, under which are taken up soil and soil-agronomic investigations, collateral soil and soil-agronomic investigations, soil-engineering and soil-engineering-agronomic investigations, soil-vegetative investigations, surveys, and education and extension activities. It is proposed "to determine the efficacy, practicability, and cost of all promising means relating to the prevention, control, and reduction of erosion and excessive run-off of rain water," and to carry the results to users of the land according to the specific needs and adaptabilities of their soils.

The fungus flora of the soil, H. L. JENSEN (*Soil Sci., 31 (1931), No. 2, pp. 123–158*).—From the State Laboratory of Plant Culture, Lyngby, Denmark, the author contributes a report of direct microscopical observations in the soil, "direct isolations," and plate counts, together with culture studies concerned with the fungus flora of 100 Danish soils ranging in pH value from 3.34 to 8.35.

"Microscopical examination showed the largest amounts of mycelium in acid soils rich in organic matter. Direct isolation yielded mainly Trichodermae from forest, moor, and heath soils, and mainly Mucoraceae from field, garden, and salt marsh soils. Plate counts showed numbers of fungi ranging from 24,300 to 46,000 to a gram of soil. Most common were the genera Mucor, Zygorhynchus, Absidia, a sterile form resembling *Cunninghamella elegans*, Penicillium, Trichoderma, and Fusarium. Besides these a number of genera of less constant occurrence were found. The Aspergilli were found only sporadically in ordinary soils but very abundantly in hot greenhouse soils. The

genera Fusarium and Phoma were characteristic of cultivated soils. The numbers of fungi showed no clear relationship to the type of soil, except that very heavy clay soils were poor in fungi; and no relation to the soil reaction was found. The numbers of bacteria plus actinomyces increased, generally, with increasing pH values up to pH above 6, but the correlation between these numbers and the hydrogen-ion concentration was not very close, the correlation coefficient amounting to only —0.32. The ratio of fungi to bacteria plus actinomyces varied from 0.87 to 0.0026 and showed a very close correlation to the hydrogen-ion concentration, viz, a correlation coefficient of 0.82 for the whole set of data. From pH 6 and upwards this correlation did not exist, but it became manifest in the pH interval 5–6. A corresponding coefficient of very nearly the same numerical value could be calculated from the data of Waksman.

"Addition of lime to acid soils did not markedly depress the numbers of fungi, but stimulated the bacteria and actinomyces greatly. The resistance of fungi to acidity varies considerably, some species growing at pH 1.5, others being checked at pH 3.7–4.2. Only a few of them show a distinct optimum at acid reaction. The pH interval of 5.0–6.0 is critical for the majority of the ordinary soil bacteria, and most soil actinomyces are checked in their growth at pH 4.4–5.

"Fertilization, especially with farmyard manure, increases the number of fungi in the soil, as well as those of bacteria and actinomyces. In soils of pH above 6 there is a significant positive correlation between the numbers of fungi and of bacteria plus actinomyces. . . .

"Addition of dextrose to soil stimulated the fungi greatly in acid soil, but little or not at all in neutral or alkaline soil. The bacteria were affected reversely. Also here the difference appeared in the pH interval 5.1 to 5.9. The sugar appeared to be equally rapidly decomposed in acid and alkaline soil. Most fungi except the Mucoraceae were capable of decomposing cellulose. Addition of cellulose gave rise to an abundant development of fungi in both acid and alkaline soil. Penicillia and Trichodermae prevailed in the acid soil, *Mycogone nigra* and *Coccospora agricola* in the alkaline soil. The fungi of the former group were more resistant to acidity and decomposed cellulose more rapidly in acid soil, whereas the reverse was true of those of the latter group. Addition of casein gave rise to an abundant development of fungi (especially of Penicillia and Mucoraceae) in acid soil but not in alkaline soil, except when cellulose was also added. Alfalfa seed meal caused an abundant development of Penicillia and Mucoraceae in acid soil, and a somewhat more limited growth of Mucoraceae and Fusaria in neutral to alkaline soil.

"The proteolytic power of the soil fungi varied considerably according to the experimental conditions, but would in several instances rival or exceed that of *Bacillus mycoides* and *Actinomyces griseus*. The most strongly proteolytic fungi were not necessarily those appearing to grow most actively when protein was added to the soil."

The soil and the microbe, S. A. WAKSMAN and R. L. STARKEY (*New York: John Wiley & Sons; London: Chapman & Hall, 1931, pp. XI+260, figs. 85*).—This is an introduction to the study of the microscopic population of the soil and its rôle in soil processes and plant growth.

The chapter headings follow: The soil and the plant, the microbe and its activities, the soil population and its distribution, rôle of microbes in the decomposition of organic substances in the soil, transformation of nitrogen by soil microbes, transformation of mineral substances in soil through the direct

or indirect action of microorganisms, interrelationships between higher plants and soil microorganisms, modification of the soil population, and importance of microbes in soil fertility.

The absorption of ammonium and nitrate nitrogen by various plants at different stages of growth, J. A. Naftel (*Jour. Amer. Soc. Agron., 23 (1931), No. 2, pp. 142–158, figs. 5*).—Cotton seedlings were grown in solution, sand, and soil cultures with the nitrogen supply in the form of an ammonium salt, a nitrate, or a mixture of the two forms of nitrogen.

Young cotton seedlings (up to from 3 to 5 weeks old) used more ammonium nitrogen than nitrate nitrogen. Later, more of the nitrate than of the ammonium ion was found to be taken up. Further, "the data show that both ammonium and nitrate nitrogen were absorbed in large amounts when the plants were 4 to 8 weeks old. Both growth and fruiting of plants were largest when both forms of nitrogen were present. Ammonium nitrogen absorption increased as the acidity of the culture solution decreased; the absorption of nitrate nitrogen was only slightly affected by the reaction of the solution used. The highest total nitrogen absorption usually occurred at pH 6.0. Total nitrogen absorption was greatest when both forms of nitrogen were present. The growth and fruiting of cotton in field plats agreed well with that of the culture solutions. Data are presented which indicate that nitrogen in the seed is available to the sprouts and young seedlings in the ammonium form."

Modification of soil nitrogen and organic matter by Austrian winter peas, M. M. Oveson and W. L. Powers (*Jour. Amer. Soc. Agron., 23 (1931), No. 5, pp. 372–387*).—The growth of Austrian winter peas as a green manure crop was found by the Oregon Experiment Station to increase both the nitrogen and the organic matter contents of the soil, moisture control and a good supply of calcium in the soil contributing to the result. Further findings are thus stated:

"The total nitrogen of the soil remained unchanged when the crop was harvested and removed in all cases except where alfalfa tops were used as a fertilizer material. In this case there was a slight decrease in the nitrogen balance of the soil. The total nitrogen balance where peas were grown and harvested, including nitrogen in the crop, was higher than where peas were grown and turned under. The nitrogen content in the tops was highest in peas grown on the soil containing the higher nitrogen content. Changes in the organic carbon content of the soil tended to vary with those of the nitrogen content where the peas were either harvested or used as a green manure crop. However, the turning under of the pea crop tended to narrow the nitrogen-carbon ratio of the soil. The addition of alfalfa tops to the soils decreased the amount of nitrogen fixed by the pea crop, but helped to maintain the nitrogen-carbon ratio more nearly like that of the initial soil. . . . The fallow soils showed no increase in nitrogen content, although Azotobacter were present."

The diagnostic value of plant symptoms in determining nutrient deficiencies of soils, J. P. Jones (*Jour. Amer. Soc. Agron., 23 (1931), No. 5, pp. 352–356*).—Various methods and indices, including the use of tobacco as an indicator plant as reported by Morgan (E. S. R., 61, p. 622), are discussed.

"In the present stage of development perhaps the greatest value of plant symptoms in determining nutrient deficiencies is their relation to other methods. Like all methods the indications of plant symptoms frequently need supporting evidence to justify a conclusion. When other methods are applied with a result that corresponds with the indications given by the plant, the investigator usually has confidence that he is approaching the solution of his problem. On

the other hand, he is not satisfied, even in the face of strong evidence from various tests, if they are contrary to what the plant itself shows. This should be regarded as a desirable situation lest agronomists be misled by neglect of the plant and too great emphasis on laboratory tests."

Crop yields from Illinois soil experiment fields in 1930, F. C. BAUER (*Illinois Sta. Bul. 370 (1931), pp. 213–264, fig. 1*).—The present bulletin continues the series previously noted (E. S. R., 63, p. 515) with yield and treatment data recorded for 1930. The general interpretation is again that "no one system of soil treatment will give the best results on all soils."

Free-ammonia injury with concentrated fertilizers, L. G. WILLIS and W. H. RANKIN (*Indus. and Engin. Chem., 22 (1930), No. 12, pp. 1405–1407, figs. 3*).—Cottonseed meal, used as a fertilizer representative of the organic ammoniates that are readily ammonified, was found capable of causing serious root injury to seedling plants on light, sandy North Carolina soils. The injury was found to be related to a high concentration of free ammonia in contact with the roots, and was controlled by neutralizing this ammonia with gypsum or allowing the fertilizer to remain in the soil until the ammonia had been dissipated by diffusion or volatilization. Nitrification in the presence of the free ammonia seemed not to be effective as a preventive of injury. In concentrated fertilizers with ingredients decomposable into free ammonia some calcium salt appeared necessary.

Composition and cost of commercial fertilizers in New York from 1913 to 1930, A. W. CLARK, W. F. WALSH, and F. J. KOKOSKI (*New York State Sta. Bul. 594 (1931), pp. 19*).—Continuing previous reports (E. S. R., 60, p. 719), this bulletin presents numerous facts in relation to commercial fertilizers in New York for the year 1930, together with a comparison of the composition and cost of fertilizers for the period of 1913 to 1930.

In the case of complete fertilizers, the average amount of plant food is shown to have been greater in recent years than at any previous time in the history of the fertilizer trade. This is by reason of a marked increase in the number of high-analysis or concentrated fertilizers.

AGRICULTURAL BOTANY

Control of moisture content of air and wood in fresh-air chambers, I. HATFIELD (*Jour. Agr. Research [U. S.], 42 (1931), No. 5, pp. 301–305, fig. 1*).—An apparatus for maintaining constant relative humidity based on the use of a saturated solution of a salt in contact with an excess of the same salt is described and discussed. By using different salts and constant temperature, the author was able to maintain a graded series of relative humidities ranging from 98 to 58 per cent.

Effect of the structure and moisture of plant containers on the temperature of their soil contents, L. H. JONES (*Jour. Agr. Research [U. S.], 42 (1931), No. 6, pp. 375–378, fig. 1*).—Measurements taken at the Massachusetts Experiment Station of the temperature of soil contained in standard flower, paper, peat, and fiber pots, and glass containers, and of the surrounding air showed that the soil within the porous flower pot may have a temperature as much as 20° F. below that of the soil in a glass container. The soil in the glass receptacle followed closely the temperature of the air, and that in the paper and peat pots ranged between the clay and the glass receptacles. The differences are ascribed to the heat lost in evaporation of moisture from the outer surfaces of the containers.

Plant material introduced by the Office of Foreign Plant Introduction, Bureau of Plant Industry, July 1 to September 30, 1929 (*U. S. Dept. Agr., Inventory 100 (1931), pp. 44*).—Herein are listed and in some instances described a total of 809 plants introduced into the United States for trial.

A new method of direct counting of cells under the microscope in the general plan of microbiological analysis [trans. title], S. A. Korolev (Koboljeff) (*Trudy Vologodsk. Moloch. Khoz. Inst. (Arb. Milchw. Inst. Wologda) Bul. 77 (1929), pp. 31–93*).—In this paper the author describes a new method for the direct counting of bacteria in milk under the microscope. In this method the cells of a special type of yeast are so treated that they take on an intense dark violet color. A known number of these colored cells are suspended in a 5 per cent solution of phenol, and the suspension is used as a standard. Equal volumes of the standard and of the unknown culture on which the count is to be made are mixed. Smears of known volume are prepared from the mixture, dried, and stained with methylene blue. This process stains the standard yeast cells, while the other cells are not colored. The cells from the standard and the unknown are then counted, using the counts on a number of fields as the average. The author also gives modifications of the method for several other substances besides milk.

GENETICS

Evolution in a Mendelian population, S. Wright (*Anat. Rec., 44 (1929), No. 3, p. 287*).—Attention is called to the fact that frequency of given genes in a population is influenced by such factors as mutation, selection, migration, and chance variation, but that the frequencies fluctuate about an equilibrium determined by size of population and other factors. In small populations there is nearly complete random fixation resulting in a static condition except for new variations. In a large population there is greater variability. With changed conditions gene frequencies may shift to new equilibrium points, and in large but subdivided populations there is a continual shifting differentiation among the local races which, through intergroup selection, may bring about much more rapid evolution of the species as a whole.

The side-chain theory of the structure of the gene, D. H. Thompson (*Anat. Rec., 44 (1929), No. 3, p. 288*).—This theory is based on the assumption that the gene consists of a main particle or protosome, with other particles or episomes attached to it. Examples of this relationship are selected from certain genetic experiments, and the theory is extended to include other series of mutational phenomena.

On the principles of the chromosome theory of inheritance in man with special consideration of blood groups [trans. title], F. Bernstein (*Ztschr. Induktive Abstam. u. Vererbungslehre, 57 (1931), No. 2–3, pp. 113–138*).—This is a mathematical consideration of the possibilities expected on the basis of the different hypotheses advanced for explaining the inheritance of blood groups in man.

The genetics, breeding, and improvement of corn and cotton, compiled by C. K. McClelland (*[Fayetteville, Ark.]: Compiler, 1930, pp. 48+26*).—The 834 titles relating to corn and the 468 dealing with cotton listed chronologically with references to abstracts in abstract journals in this bibliography report research largely published on within the period 1889–1929. Lists of the characters within the linkage groups of corn and of the heritable characters of corn also are included.

Genetic factor relationships in the B–Lg group in maize, H. E. Brewbaker and H. K. Hayes (*Jour. Amer. Soc. Agron., 22 (1930), No. 12, pp.*

1035–1040).—In genetic studies with corn at the Minnesota Experiment Station, the factor gl_4, recessive for glossy seedlings, was shown to be independent of eight linkage groups and the factor pair *Fl fl* for flinty v. floury endosperm to be independent of nine groups. See also earlier notes (E. S. R., 59, p. 126; 61, p. 216).

A second case of silklessness in maize, E. G. ANDERSON (*Mich. Acad. Sci., Arts, and Letters, Papers, 9 (1928), pp. 1–3*).—The silkless character *sk* evident in silkless plants appearing in a culture grown from selfed seed of Payne White Dent seemed identical with that described by Jones (E. S. R., 54, p. 630).

The genetics of flax [trans. title], T. TAMMES (*Züchter, 2 (1930), No. 9, pp. 245–257, figs. 19*).—This résumé of research on the genetics of flax cites 44 references.

Inheritance of the dwarf branching habit in sweet clover, A. E. CLARKE (*Sci. Agr., 11 (1931), No. 6, pp. 326–332*).—The dwarf branching habit in several strains of white sweetclover studied at the Wisconsin Experiment Station was found to result from either of two genes, bunch dwarf (*bd*) and spreading dwarf (*sd*), both recessive to normal sweetclover. Of the two genes, pg_1 and pg_2, for the development of the pale green seedling character, pg_1 appeared to be linked with *sd*, with about 21 per cent of crossing over. The dwarf branching strains, according to data presented, arose from gene mutations and not from a cross between Arctic sweetclover and alfalfa.

The origin of bread wheats, R. R. GATES (*Nature [London], 127 (1931), No. 3200, pp. 325–327*).—Attention is called to important investigations on the chromosome behavior of hybrids of cereals, crosses including cultivated and wild species of wheat, rye, oats, and Aegilops and also intergeneric crosses among the genera Triticum, Secale, Avena, and Aegilops, the results of which have thrown much light on the phylogeny of the bread wheats and their relation to other genera.

Röntgen mutations in wheat (Triticum vulgare) [trans. title], A. A. SAPEHIN (*Züchter, 2 (1930), No. 9, pp. 257–259, figs. 6*).—Numerous mutations were obtained following exposure of the spikes of many pure lines of winter and spring wheat to Röntgen rays before blooming. Chromosome aberration observed is discussed briefly.

A successful transfer of emmer characters to vulgare wheat, E. S. MCFADDEN (*Jour. Amer. Soc. Agron., 22 (1930), No. 12, pp. 1020–1034*).—Emmer characters possessed by the common wheat segregates selected from a Yaroslav × Marquis cross in experiments by the U. S. Department of Agriculture, cooperating with the South Dakota Experiment Station, demonstrated that it is possible to transfer desirable characters from wheats of the 28-chromosome group to wheats of the 42-chromosome group by crossing followed by rigid selection. All of the desired characters of the 28-chromosome (emmer) parent apparently were not only transferred successfully to 42-chromosome wheats, but they were actually combined in a single 42-chromosome variety as the result of a single cross. That these characters were not inherited as a closely linked group seemed probable, since several of them proved to be inherited independently in crosses of Hope and H44–24 with other *vulgare* wheats.

Inheritance in a wheat cross between Hybrid 128 × White Odessa and Kanred, G. STEWART and R. W. WOODWARD (*Jour. Agr. Research [U. S.], 42 (1931), No. 8, pp. 507–520, figs. 3*).—Genetic studies at the Utah Experiment Station, largely on F_3 progenies from (Hybrid 128 × White Odessa) × Kanred, showed awn classes and spike density each to be inherited on single factor bases, whereas the data suggested a three-factor difference to explain the behavior of kernel color. It was impossible to determine any cumulative effect

of the three factors for red color. Data are presented to show the actual lengthening effect of bunt on spike density.

A genetic study of wheat × rye hybrids and back crosses, V. H. Florell (*Jour. Agr. Research* [*U. S.*], *42* (*1931*), *No. 6*, *pp. 315–339*, *figs. 7*).—The 42-chromosome wheats Red Winter, Hybrid 128, and Kanred and the 28-chromosome wheats Peliss, Black Winter, Polish, and Clackamas were crossed with Rosen and Dakold rye in experiments at the California Experiment Station in cooperation with the U. S. Department of Agriculture.

The 42-chromosome varieties were fertilized quite easily with rye pollen, while those with 28 chromosomes were fertilized with difficulty or not at all. The F_1 wheat × rye hybrids were completely self-sterile. Although both dominant and intermediate wheat or rye characters were present, in general the F_1 plants were more like wheat than rye. The F_1 plants produced a small percentage of viable kernels upon back-crossing. F_1 hybrids of Hybrid 128 and Kanred wheats crossed with Dakold and Rosen ryes were back-crossed to their respective wheat parents, and these back-crosses were again back-crossed to the same wheat parents. Selfed as well as back-crossed plants in the first back-cross first generation and in the second back-cross first generation and second generation were bagged to prevent contamination with foreign pollen. Compared with unbagged plants in 1928, bagging reduced fertility 17.9 per cent in Hybrid 128 and 19.7 per cent in Kanred.

The fertility was increased by back-crossing with the parent wheat, and progeny plants became more wheatlike. Viable seeds from the back-cross on F_1 and from the back-crosses on first-generation back-crossed plants produced about 74 and 16 per cent of sterile plants, respectively. The progeny of selfed plants also tended to become more wheatlike. Parent types were recovered in the second back-cross second and third generations. The plants with red kernel color, hairy neck, and long kernel from wheatlike families of Hybrid 128 × Rosen back-crosses usually exhibited reduced fertility, those with red kernels appearing least fertile. The plants with light hairy neck were more fertile than those having heavy hairy neck. A wheatlike, nearly homozygous, red-kerneled progeny and an apparently homozygous hairy-necked progeny obtained indicated the possibility of producing constant wheat × rye strains.

A cytologic study of wheat × rye hybrids and back crosses, V. H. Florell (*Jour. Agr. Research* [*U. S.*], *42* (*1931*), *No. 6*, *pp. 341–362*, *figs. 9*).—To explain the phenomena described above, knowledge of the chromosome relationships of the hybrid progeny was deemed necessary. Counts of chromosomes from root tips of Hybrid 128 wheat revealed 42, Rosen rye 14, and their F_1 hybrids 28. From 0 to 3 bivalents and from 28 to 22 univalents were found in F_1 pollen mother cells, and cells with 2 bivalents apparently predominated.

Results of back-crossing with the wheat parent showed that a small number of viable gametes are formed. Somatic chromosome number in 10 first back-cross first-generation plants (9 from root tips) varied from 40 to 49. The gametic chromosome numbers of the F_1 ovules, therefore, varied from 19 to 28. The gametes with high chromosome numbers (28 and 26) must have been formed as somatic gametes, those with lower numbers (19 to 21 or 22) probably by a random assortment. The somatic chromosome counts from root tips in 25 first back-cross third-generation and second back-cross third-generation plants revealed chromosome numbers varying from 42 to 47.

Plants of a second back-cross third-generation family of Hybrid 128×Rosen, segregating only for kernel color, had 42, 43, and 44 chromosomes, red-kerneled plants 43 and 44, and white-kerneled plants 42 chromosomes. Twenty-two bivalents were found in pollen mother cells of two 44-chromosome plants whose

subsequent behavior was almost normal. In the white-kerneled plants chromosome behavior was normal. In two hairy neck families, one segregating for color of kernel and the other for length of kernel, somatic chromosome numbers varied from 43 to 45 in the first family and 42 to 47 in the second. Almost all plants had from 1 to 5 univalents, and tetrad and pollen formation was abnormal.

The cytologic and genetic behavior seemed to indicate that by back-crossing wheat×rye hybrids with wheat it may be possible to produce constant wheatlike strains possessing rye characters. Rye factors apparently may be added to the wheat complement as whole rye chromosomes.

Genetic factors for pigmentation in the onion and their relation to disease resistance, G. H. RIEMAN (*Jour. Agr. Research [U. S.], 42 (1931), No. 5, pp. 251–278, pls. 3*).—In this study, conducted at the University of Wisconsin, there were isolated in the onion two genes each possessing the capacity for producing a definite water-soluble chemical entity, namely, protocatechuic acid, which is extremely toxic to the organism *Colletotrichum circinans* that produces smudge in the onion. These two genes, designated as W and W^y, were also responsible, respectively, for the production of red and yellow pigments containing the water-insoluble pigment quercetin. For the interpretation of the results obtained in the F_1 to F_4 generations five genes governing bulb pigmentation are suggested, namely, I governing incomplete inhibition of color, i controlling the expression of color, W for red pigment, W^y for yellow pigment, and w for white. The inhibitor gene I was found dominant to its recessive allelomorph i. The heterozygous pair Ii produced red neck and cream colored bulbs in the presence of the color genes W or W^y. Independent inheritance was demonstrated between the allelomorphic pair Ii and the color genes. W was dominant to W^y and to w, and it is assumed that the gene W is allelomorphic to W^y and w, but a similar relation between W^y and w was not demonstrated. The color inhibiting gene I interacts with the W gene to produce bulbs possessing intermediate resistance.

Further observations and experiments on inheritance in swine [trans. title], C. KRONACHER (*Ztschr. Zücht., Reihe B, Tierzücht. u. Züchtungsbiol., 18 (1930), No. 3, pp. 315–365, figs. 41*).—Continuing this series (E. S. R., 62, p. 222) data are reported concerning the litters and the characteristics of the individual pigs produced in matings between several breeds and grades, including native wild stock, Improved Landschwein, White Edelschwein, Berkshire, Tamworth, Middle White, and other breeds, as well as the crossbred individuals between them.

A new dilution factor in pigeons, W. CHRISTIE and C. WRIEDT (*Hereditas, 15 (1931), No. 1, pp. 89–96, fig. 1*).—Data collected by the authors prior to their death are presented by M. Bjaanes.

The results from matings of gimpel pigeons with self-colored blacks and recessive and dominant reds confirmed Horlacher's conclusion (E. S. R., 64, p. 25) that gimpel is recessive to black and recessive red. The occurrence of a few F_1 gimpels suggested the possibility of a variable expression of the gimpel factor in the heterozygous form combined with the effect of modifying genes. All gimpels used in the experiment were found to carry black.

Studies of the intensity factor in copper and gold gimpel pigeons indicated that the copper gimpel was intense. Matings of gold gimpels, which showed the combination of yellow (dilute) on the head, breast, and underparts, and black (intense) on the wings, back, and tail, with dilutes produced offspring showing a variable and intermediate grade of intensity. This condition is suggested as due to a third allelomorph (d_1) in the intense series, although there were

five d_1 individuals produced in matings of *Dd* males and *d* females, and one dilute female from the mating of Dd_1 males and *d* females. These are considered to be due to errors in classification. The difference between the copper and gold gimpel pattern thus appears to be due to the presence of the intense *D* factor in copper birds, and the presence of the intermediate factor for intensity (d_1) in gold gimpels.

Linkage groups in poultry, D. C. WARREN (*Anat. Rec., 44 (1929), No. 3, pp. 286, 287*).—Data are presented which indicate independent inheritance in the male of factors for naked neck, rumpless, rose comb, and white shank color in fowls. The factor for black was independent of rumpless, naked neck, and rose comb; and shank feathering was independent of rose comb. There was slight evidence for loose linkage between feathered shank and pea comb in females.

Preliminary studies of hereditary resistance in mice to a specific bacterial infection, R. G. SCHOTT (*Anat. Rec., 44 (1929), No. 3, p. 283*).—In successive generations of selection the resistance of mice to *B[acillus] aertrycke* was increased from 18.5 to 30.3 per cent in the first selected generation and 56.7 per cent in the second selected generation.

Stillbirths in a mouse interspecific cross (Mus musculus × Mus bactrianus), C. V. GREEN (*Soc. Expt. Biol. and Med. Proc., 28 (1930), No. 1, pp. 55–57*).—Data on the offspring produced in an interspecific cross of dilute brown nonagouti mice (*M. musculus*) and small, light-colored, white-bellied, genetically intense black agouti mice (*M. bactrianus*) are presented. The F_1s were intermediate in body weight, but in certain skeletal measurements they excelled the larger parent. The litter size averaged 6.4±0.12, as compared with 5.4±0.04 for *M. musculus* and 4.6±0.11 for *M. bactrianus*. The percentages of stillbirths in the respective stocks were 10.84±0.24 and 2.84±0.53. The effect of heterosis was apparent in F_1 dams, which produced 0.88±0.26 per cent of stillbirths when mated with *M. musculus* males. When hybrid males were back-crossed with *M. musculus* females, the percentage of stillbirths was 9.11±0.80.

Inheritance in a mouse species cross, C. V. GREEN (*Amer. Nat., 64 (1930), No. 695, pp. 540–544*).—Study of the mice produced in the interspecific cross of *Mus bactrianus* and *M. musculus*, noted above, showed that the eight color combinations occurred in the back-cross generation in approximately equal numbers, and there was no indication of any change in the sex ratio in the hybrid generation although the back-cross showed some indication of an increased production of males. F_1 animals were intermediate in body length, tail length, relative tail length, number of caudal vertebrae, and adult weight. In skeletal measurements, however, both F_1 and back-cross mice largely equaled or surpassed the larger parent race. The back-cross individuals were compared as to the relative size of 10 body measurements and the association of these with the dominant and recessive color characters. From these findings it is concluded that there is indication of linkage between the relatively larger size and the recessive color characters of the *M. musculus* parent.

The inheritance of size in mice appears to be of the blending type with increased variability in the back-cross as compared with the F_1 generation.

Revised terminology for the chief color factors concerned in crosses among the breeds of the turkey, W. R. B. ROBERTSON (*Anat. Rec., 44 (1929), No. 3, p. 289*).—Further analysis of the color factor in turkeys (E. S. R., 64, p. 728) indicates that the bronze or wild type is the normal, with black differing from it by a dominant factor, *Bl*. Bourbon red differs from bronze by an incompletely recessive factor, *r*. Various combinations of these genes account

for the fundamental breed colors, black (*BlBlRR*), black carrying occasional bronze feathers (*BlblRR*), black-red (*Bl—Rr*), bronze (*blblRR*), bronze-red (*blblRr*), black-eyed red (*Bl—rr*), and bourbon red (*blblrr*). Narragansett differs from bronze by carrying a recessive sex-linked factor, *n*. Slate differs from bronze by the presence of a dominant dilution factor, *Sl*. A recessive factor, *w*, causes the white in the White Holland breed, but this factor does not affect the color in the iris.

The question of sex hormone antagonism, C. R. Moore and D. Price (*Soc. Expt. Biol. and Med. Proc., 28 (1930), No. 1, pp. 38–40*).—The testis hormone and oestrin were found to have no antagonistic effect on each other when injected into normal and castrated rats, but the gonadal hormones suppressed the hypophysis, thus making available a reduced amount of the gonad-stimulating secretion which is necessary for gametogenesis.

***An experimental study of the factors concerned in mammary growth* and in milk secretion,** W. O. Nelson and J. J. Pfiffner (*Soc. Expt. Biol. and Med. Proc., 28 (1930), No. 1, pp. 1, 2*).—Studies of the influence of ovarian hormones on lactation showed that although oestrin and corpora lutea extract would stimulate growth in the mammary gland of the guinea pig, it was necessary to administer anterior pituitary extract to initiate the flow of milk.

The physiological effect of pituitary extract (posterior lobe) on the lactating mammary gland, C. W. Turner and I. S. Slaughter (*Jour. Dairy Sci., 13 (1930), No. 1, pp. 8–24, figs. 3*).—To study the effect of pituitrin on lactation, doses varying from 2 to 12 cc. were injected into a cow following the evening milking. It was found that the amount of milk withdrawn 30 minutes later increased until 6 cc. were injected, and the percentage of fat showed a gradual rise as the amount of pituitrin was increased. There was also a temporary inhibition of milk secretion following the initial rise, the degree of inhibition varying with the amount of pituitrin injected. The dose of 10 cc. of pituitrin inhibited milk producton for approximately 10 hours. These findings were based on hourly milkings subsequent to the injection. Milking at 10-minute intervals following the injections indicated that the time required for the pituitrin to become effective was related to the size of the dose, the largest yield of milk being obtained at the end of 10 minutes when 12 cc. were injected, whereas 20 minutes were required for the greatest yield when 6 cc. of pituitrin were administered.

A study of the composition of the milk indicated that pituitrin affects chiefly the fat content. Analysis of the results showed that pituitrin causes a more complete discharge of milk already formed in the udder rather than an actual stimulation of milk production; thus pituitrin is not a true galactogogue. It also appeared that pituitrin had a secondary physiological influence, although temporary, in inhibiting milk secretion, possibly due to a contraction of the vascular system or of the smooth muscle elements.

FIELD CROPS

Extension of Pearson's correlation method to intraclass and interclass relationships, J. A. Harris and B. Gunstad (*Jour. Agr. Research [U. S.], 42 (1931), No. 5, pp. 279–291*).—Consideration of the problem of the extension of Pearson's biserial correlation method to intraclass and interclass distributions showed that both intraclass and interclass biserial correlation coefficients might readily be determined from the moments calculated from the original data. Illustrations of the application of the method to the problem of the influence of field heterogeneity, in the sense in which that term was used in earlier papers

(E. S. R., 33, p. 727; 43, p. 526; 44, p. 631; 58, p. 631; 59, p. 30), on seedling stand in sea island and Durango cotton are given.

[**Crop production experiments in Massachusetts**], A. B. Beaumont, G. Rohde, E. F. Gaskill, R. W. Donaldson, R. E. Stitt, R. C. Foley, and E. A. Hollowell (*Massachusetts Sta. Bul. 271 (1931), pp. 236, 237*).—Additional evidence (E. S. R., 63, p. 523) obtained showed that bluegrass, timothy, redtop, English ryegrass, red clover, and alsike clover assimilated nitrate nitrogen better than that from ammonium sulfate and urea. Differences in the growth of the grasses appeared in the later stages, while with clovers differences due to form of nitrogen were earlier and more pronounced.

Current results indicated that slight effect may be expected from lime, phosphorus, and potassium the same year applied as top-dressing to pasture, whereas all nitrogen forms are more or less effective the first year. Similar evidence was also obtained on outlying fields in Worcester County. In a palatability test Holstein cows chose pasturage in the order white clover, timothy, redtop, and bluegrass. Little, if any, effect of different fertilizer treatments on palatability was noted, although indications were that grass from plats receiving the most nitrogen was preferred by the animals. On certain Hohenheim plats (E. S. R., 64, p. 133) seedings containing a high proportion of timothy were preferred by dairy animals. Sodium nitrate used as a top-dressing for a mossy pasture acted as a mild toxin for moss, killing it permanently to a considerable extent without injuring desirable vegetation.

The relative merits of different sorts of alfalfa, soybeans, field peas, and vetch are indicated from variety trials. None of the soybeans, field peas, or vetch with only one cutting yielded as much hay as well adapted alfalfa varieties cut twice or more per season, suggesting that such annual legumes be considered mainly as emergency substitutes for alfalfa and clovers. It was found unwise to seed alfalfa on sod land in Massachusetts without the intervention of at least one year of tilled crop or fallow to kill weeds, especially grasses.

Fertilizer applied in the hill of corn continued to give better results than the same and sometimes larger quantities broadcasted. Fertilizer applied in the hill at the rate of 500 lbs. was superior to 500 or 1,000 lbs. broadcasted.

Corn production on heavy plains soils, H. H. Finnell ([*Oklahoma*] *Panhandle Sta., Panhandle Bul. 27 (1931), pp. 11–16*).—Corn production in the High Plains region is thought, from results at Goodwell and at stations in adjacent States, to depend largely upon soil type and atmospheric conditions, the crop requiring a deep sandy soil and a mild growing season. In most seasons heavy silt loam at Goodwell was not suitable for corn. Although their yields were not high, Australian Flint and Brazilian Flour were certain of production every year, while Surecropper, an early hardy dent, averaged highest, although fluctuating more in yields.

Cotton production in Missouri, B. M. King (*Missouri Sta. Bul. 299 (1931), pp. 34, figs. 8*).—Spacing, fertilizer, and variety tests with cotton were made on the four principal soil types used extensively for the crop in the lowlands of southeastern Missouri. Cultural and field practices are outlined, with accounts of insect enemies of cotton and cotton diseases and methods for their control.

From 16 trials, 2 to 4 plants in hills 10 to 12 in. apart averaged 424 lbs. of lint per acre, and single plants in hills 12 in. apart 405 lbs. and in hills 18 in. apart 377 lbs. Yields in close and medium spacing did not differ much, and under certain conditions close-spaced plants tended to grow tall and spindling at the expense of fruiting.

Applications of 400 lbs. per acre of 4–12–4 fertilizer at Hayti and Kennett was the most effective treatment on land where black rust does not occur. At Whiteoak on land where cotton is normally seriously damaged by black rust, 200 and 300 lbs. per acre of 14 per cent kainite gave marked yield increases.

Delfos, a dwarf, early prolific, long staple cotton, was a good yielder on rich, heavy land. Trice, while not superior in yields, was very hardy in early growth and matured very early, which marked it as one of the best short staple varieties on land where cotton tended to grow rank and mature late. These varieties were very inferior on poor sandy land or even on good land where black rust and wilt were severe. Acala and Cleveland led in yields on the fine sandy soils of only moderate fertility. Express was more widely adapted to different soil conditions than any other cotton tested but was very hard to pick.

Early defloration as a method of increasing cotton yields and the relation of fruitfulness to fiber and boll characters, F. M. Eaton (*Jour. Agr. Research [U. S.], 42 (1931), No. 8, pp. 447–462, figs. 3*).—Allowing a boll to develop only at the first node in any fruiting branch of Acala or Pima Egyptian cotton grown at Sacaton, Ariz., decreased the number of bolls, while removal of all flowers during the first 25 days of blooming resulted in substantially higher yields in both cottons whether yields were measured in terms of number of bolls or weight of seed cotton or of fiber. An increase of over 24 per cent in the yield of Acala was obtained when all bolls and flowers and the larger squares were stripped from 100 plants alternately spaced with control plants. Plants were so treated on the eighth day of the flowering period and again produced flowers 14 days later.

In general the treatments influenced the weight of burs more than the weight of seed cotton and the weight of seed more than the weight of the fiber, whereas number of locks per boll and the boll maturation period were not affected much. Examination of the lint showed that early defloration or stripping as a means of increasing yields also is warranted from the viewpoint of the quality of the fiber produced.

Experiments with hay crops in Alabama, D. G. Sturkie and R. Y. Bailey (*Alabama Sta. Circ. 58 (1931), pp. 18, figs. 4*).—In comparisons of single crops and mixtures for hay during the period 1922 to 1930 cowpeas outyielded soybeans either in drills or broadcast. Mixtures of either summer or winter crops usually yielded more than single plantings. A mixture of oats and Austrian Winter peas made the largest yields of any winter crops used. Biloxi, Otootan, Mammoth Yellow, Tarheel Black, and Laredo led soybean varieties in the order named in hay yields. Otootan and Laredo were fine stemmed and made hay of excellent quality. The Virginia, Dixie, and Arlington varieties made moderate yields of both hay and seed and were suitable for early grazing.

Applications of lime increased the hay yields from oats, Austrian Winter peas, and Otootan soybeans more than did superphosphate. Substantial hay increases also followed the use of basic slag. When grown on plats fertilized annually for 20 years with sodium nitrate, cyanamide, and ammonium sulfate, the best yields usually were made by various forage crops on the cyanamide plat, whereas the yields of Sudan grass, sorghum, and soybeans were depressed greatly on the quite acid ammonium sulfate plat. Sodium nitrate was most profitably applied to Sudan grass soon after the grass was up and at rates of 100 to 200 lbs. per acre.

Tests on sandy loam showed that large annual yields of hay were made by sowing a winter hay crop with Johnson grass, and that Johnson grass must be reseeded each year on this soil. A crop of winter legumes should be cut for hay rather than turned for Johnson grass. Small legumes grown in con-

nection with Johnson grass did not supply nitrogen enough to increase materially the yield of Johnson grass hay. Johnson grass responded well to nitrogen and lime, but not to phosphorus on this soil. Johnson grass made its largest hay yields when cut when the seed were in the late milk stage (E. S. R., 63, p. 227). Cutting before this stage reduced the yields and thinned the stand. Cutting often during the latter half of the growing season was found to reduce the development of rootstocks and assist in eradicating Johnson grass.

Columbia oats, a new variety for Missouri, L. J. Stadler and R. T. Kirkpatrick (*Missouri Sta. Bul. 296 (1931), pp. 12, figs. 5*).—This revision of Bulletin 278 (E. S. R., 63, p. 228) also includes data on the relative yield and behavior of Columbia and other oats in tests during 1930.

Spraying and dusting experiments with potatoes on Long Island, H. C. Huckett (*New York State Sta. Bul. 592 (1931), pp. 38, figs. 5*).—Experiments in spraying and dusting Irish Cobbler and Green Mountain potatoes were made during the period 1926–1930, largely at Riverhead. The methods used to combat the various parasites invariably were successful in protecting the foliage from injury, yet this did not always result in profitable increased yields. The causes for these results were believed to be entirely local in nature, even on Long Island. Moisture, soil, and atmospheric conditions during July and August seemed to be important determining factors and to vary considerably in their influence during certain seasons from one to another part of Long Island. Recommendations are given for the control of Colorado potato beetle by spraying or dusting and for the control of other potato pests in different parts of the island.

With Irish Cobbler potatoes one of five tests at Riverhead gave profitable increases in yield from continued treatment, and four gave no gains. The most important parasites of the foliage during the period, except with the Colorado potato beetle, were aphids and flea beetles in 1927 and 1929, late blight in 1928, and flea beetles in 1930. The results of dusting and spraying did not differ significantly. In the dry season of 1929 foliage in sprayed plats was noticeably in better condition than in dusted plats, but the yield of tubers was, if anything, superior in dusted plats. Nicotine in spray or dust forms did not result in further yield increases from spraying and dusting operations.

In the case of Green Mountain potatoes 5 of 10 tests at Riverhead gave profitable increases from continued treatment and 5 no gains, while 2 tests in other localities gave profitable gains. Eliminating the Colorado potato beetle from consideration, it was estimated that in 1926 and 1930 no parasites became of commercial importance, that in 1927 and 1929 aphids and leafhoppers were of major significance, while in 1928 there was a sharp but short attack of late blight. Results from copper treatments in spray form averaged slightly superior to those in dust form. Nicotine in dust form was more reliable, and, when aphids were a limiting factor, gave superior results to nicotine in spray. Nothing was gained by making heavier applications of spray by a 4-row boom with 3 nozzles per row as compared with applications by a 6-row boom with 2 nozzles per row. Differences in foliage as a result of various treatments were not generally followed by comparable differences in yield of tubers. Nicotine treatments in three of the five seasons were not warranted by events following application, owing in part to the checking or destruction of aphids by natural agencies. In one of two seasons when aphid control resulted in satisfactory yield increases all profit due to the operation was lost owing to the partial failure of the crop from drought.

Grain sorghum date-of-planting and spacing experiments, R. E. Karper, J. R. Quinby, D. L. Jones, and R. E. Dickson (*Texas Sta. Bul. 424 (1931)*,

pp. 71, figs. 9).—Experiments with grain sorghum varieties planted at different dates, at different spacings within the row, planted in normal, paired, and wide rows, and in rows alternated with cowpeas, and also tests on rate of seeding and treatment of seed with commercial dusts are reported on from substations at Lubbock, Chillicothe, Spur, Temple, Beeville, Big Spring, and Dalhart. Brief notes are given on the soil and climatic conditions as affecting grain sorghum growth and development for each region represented by a substation. Much of the work was either by or in cooperation with the U. S. Department of Agriculture.

The highest grain yields generally were produced by Dwarf Yellow milo and feterita from planting June 15 at Lubbock, Spur, Big Spring, and Dalhart, May 15 at Chillicothe and Temple, and April 1 at Beeville. Dwarf Blackhull kafir made the most grain from May 15 planting at Lubbock, Chillicothe, Spur, and Temple, June 15 at Dalhart and Big Spring, and from March planting at Beeville. The best grain yields of hegari usually were had from the later plantings. Increased yields and better quality of forage ordinarily were produced from the later plantings. At Chillicothe June 15 plantings and at Temple May 15 plantings returned the highest yield of forage. Early planting resulted in retarded early growth and longer growth period, and good stands were harder to obtain from April 15 than from May or June 15 plantings.

Spacing studies showed that for best grain yields varieties that tiller freely need more plant space than those tillering but little. The milos, freely tillering in habit, are grown primarily for grain and should be spaced 12 to 24 in. About 5 bu., or 20 per cent, more grain was produced from milo spaced 18 to 36 in. in the row at Lubbock than when 3 to 9 in. apart. Average results at all points indicated the best spacing of milo to be 12 to 24 in. Kafir, sparsely tillering in habit, yielded best from a close spacing of around 6 in.; it yielded 10 to 20 per cent more grain, or 3 to 4 bu. more, than when spaced 12 to 24 in. Hegari and feterita tiller freely but being important forage types should be spaced 6 to 12 in. between plants in the row. The most and best forage of all varieties was made in close spacing. Kafir and milo spaced 3 to 9 in. produced 11 per cent more forage than when spaced 12 to 18 in. Indicated acre seeding rates were milo 1 lb., kafir 2 lbs., hegari 2 to 3 lbs., and feterita 3 to 4 lbs.

The yields of milo, kafir, and feterita favored planting in normal rows rather than in paired or in wide rows. The average yield decrease in paired rows compared with normal rows was 1.1 bu. and in wide rows 4.5 bu. To avoid a further decrease in yield closer plant spacing also is necessary in wider rows than in normal rows. Planting in wide rows instead of normal rows resulted in a loss of about 25 per cent in forage yields. Grain yields of Kafir were reduced 4.3 bu. and feterita 6.9 bu., or about 25 per cent, and forage yields were reduced similarly, when cowpeas were planted in the alternate rows.

The most effective dry dust seed disinfectants used increased germination and emergence of feterita 30 to 40 per cent over untreated seed. The benefits from seed treatment were more pronounced from the early dates of planting when soil-temperature conditions were least favorable for germination.

The relation of nitrate nitrogen and nitrification to the growth of tobacco following timothy, R. P. Thomas (*Wisconsin Sta. Research Bul. 105 (1930), pp. 28, figs. 7*).—The causes of the poor growth of tobacco and of browning of the roots when tobacco succeeds timothy were sought in studies in the field, greenhouse, and laboratory.

Field studies showed that when the nitrate content of timothy sod soil is low at the time of setting and this deficiency is not corrected by fertilizer the growth of tobacco is invariably poor, and brown root rot generally is

present. Poor growth of tobacco of this kind is most pronounced in the less fertile and more acid soil. Heavy application of nitrogen and phosphorus fertilizers under such conditions tends to produce nearly normal tobacco and very few brown roots.

Tobacco grown under aseptic conditions in the greenhouse grew very poorly on ammoniacal nitrogen but made good growth on nitrate nitrogen, suggesting that the crop depends largely upon nitrate nitrogen for its heavy nitrogen requirements. Very small quantities of nitrate nitrogen were found early in the season in all soils on which tobacco was subject to brown root rot, although in many of these soils nitrates were abundant later in the season. Contrariwise nitrate nitrogen was plentiful early in the season in the soils on which tobacco grew well and was free from brown root rot, emphasizing the importance of an ample supply of nitrate nitrogen in the soil at the time of transplanting. If tobacco once became affected with brown root rot, the addition of nitrate nitrogen seemed of little value.

Soils producing tobacco affected with brown root rot invariably contained much cellulose material. Applications of cellulose at the rate of 2 tons per acre to good tobacco soils also resulted in low nitrate content and poor growth of tobacco affected with brown root rot. The undesirable condition produced by large quantities of cellulose could be overcome by heavy application of easily nitrifiable materials, such as ammonium sulfate, and also phosphates if the soil lacked available phosphorus. Moderate applications of nitrogen and phosphorus did not overcome the difficulty.

On poor tobacco soils ammonium sulfate alone and lime with ammonium sulfate were the only materials producing noticeable increases in nitrate accumulation under controlled conditions in the greenhouse. Such conditions were obtained only on soils incubated at temperatures higher than found in the field at setting time. The good tobacco soils nitrified well at the lower temperature. Addition of lime with low and medium quantities of nitrogen and phosphorus to poor tobacco soils produced only slight increases in growth in the greenhouse. Lime alone or with nitrogen or phosphorus had little if any effect on the amount of brown root rot.

There was some evidence that the brown root rot of tobacco may be due to an actual invasion of the roots by certain fungi. It was suggested that an abundance of energy material may so stimulate the growth of fungi that a nitrogen shortage is created, causing one or more species of the fungi to attack the weakened roots.

Tobacco Substation at Windsor, report for 1930, P. J. Anderson, T. R. Swanback, O. E. Street, et al. (*Connecticut State Sta. Bul. 326 (1931), pp. 351–450, figs. 21*).—Continued tobacco investigations (E. S. R., 62, p. 831) in 1930 proceeded in a season generally favorable for growth of the crop. During the latter half of July, however, rain was deficient, and unusually hot, dry days caused tobacco on light lands to wilt badly. The loss from hail to the crop throughout the Connecticut Valley approached but did not equal that in 1929.

Potash fertilizer experiments (pp. 357–373).—Except for slightly lower average yields and higher grade indexes on carbonate plats, it seemed to make little difference whether the sulfate, carbonate, or nitrate of potassium or a combination of these supplied the potash for the tobacco. Ground tobacco stems were found to provide a good and adequate source of potash, and were also deemed desirable as fertilizer material since they also contain a supply of all other elements needed by the growing plants. Cottonseed-hull ashes did not surpass other carriers of potash, as judged by comparative yields and grade indexes, nor were consistently favorable influences detected on the burn, taste,

or aroma of cigars made from tobacco grown thereon compared with those from leaf raised on standard fertilizer mixtures.

The lower rates of potash used in different rate series resulted in reduction of quality rather than in reduced yield. Each increment up to 300 lbs. of potash per acre in the fertilizer resulted in increased percentage of potash in the leaves, about 1 per cent for each 100 lbs. applied. For three successive years the percentage of potash in the leaves declined steadily when special potash carriers were omitted from the fertilizer. This decline was steady but less pronounced with 100 lbs. of potash per acre and was still smaller with 200 lbs. The percentage of lime (CaO) varied inversely with potash. The percentage of magnesia (MgO) was highest where no potash was added to the fertilizer, but other rates of application did not show consistent differences.

Nitrogen fertilizer experiments (pp. 374–380).—Tobacco from plats with urea the only source of nitrogen did not grade quite so well as the others. As in previous years, the leaves of all grades from all-urea plats were a shade darker and the veins more prominent and light colored. A formula in which one-half the nitrogen is in urea seemed as good as a standard formula containing no urea. Results in tests involving Calurea closely paralleled those in the urea tests. No decline in either yield or quality occurred where Nitrophoska was used to replace about one-half or all the standard fertilizer formula on naturally strong land. Both yield and grading were reduced markedly where the larger quantities of either calcium nitrate or sodium nitrate were used, especially with sodium nitrate. As to combustion characteristics of the 1927 and 1928 crops there was no difference between the two nitrates or the quantities used.

Fractional application of fertilizer (pp. 381–383).—For dry years—i. e., without leaching rains following the first fertilizer application—results indicated that a single broadcasting is more profitable in yield and grading than fractional application of the same fertilizer. However, in years with heavy leaching rains in the growing season, yield and quality might be improved by applying some of the quickly available nitrogen carriers later, especially on coarse, sandy soils with porous subsoils subject to leaching.

Manure as a supplement to commercial fertilizer (pp. 384–387).—In the second (1927) and third (1928) years of the tests, manure in addition to regular fertilizer improved both yield and grade. By 1929, however, the results were reversed and manure plats appeared definitely inferior, and in 1930 deterioration had gone so far that the tobacco was worthless. Manure in such quantities (20 to 40 tons per acre) greatly increased the prevalence of black root rot, the most probable explanation of the decreasing yields. The soil organic matter content rose an average of about 50 per cent as a result of manuring for 5 years, and the water-holding capacity averaged 30.6 per cent for manure plats v. 27.9 per cent on checks. Leaves from manure plats had as good fire-holding capacity in strip burn tests as those from the checks, and on cigars the burn usually was somewhat superior on the manure plat leaf, in that the ash was lighter colored, the coal band narrower, and usually the taste and aroma were judged to be better.

Cover crop experiments (pp. 388–390).—From the yield and grading of tobacco produced after several cover crops, rye seemed to be an excellent cover crop for a wet year, or at least in a year, as in 1930, when rains come soon enough after the crop is turned under to rot it. During very dry years like 1929, however, decay does not proceed at the proper time to help the growing tobacco crop. Oats appeared more reliable throughout a series of years. Vetch also gave good results, but the tobacco was again a shade darker than from other plats.

The relation of magnesia to the burning qualities of cigar leaf tobacco (pp. 391–398).—In extended tests of the burning qualities of tobacco unlimed and limed with magnesian lime conducted on leaf of the 1928 crop from plats treated with acid, alkaline, and neutral formulas, respectively, in every comparison by the strip test, fire-holding capacity was reduced by liming, this being apparent during each of the 4 years of the test. Contrary to strip tests results, cigars from limed plats held fire longer than those from unlimed plats, had a lighter colored ash, and a narrower coal band, and in general were superior in taste and aroma. Analyses of the ash from the test cigars, in line with previous results, showed that application of magnesian lime to the soil resulted in a decided increase in the magnesium in the leaf and a smaller decrease in calcium. A certain percentage of magnesia in the leaf appeared essential for satisfactory combustion in the cigar, the optimum being nearly 2 per cent. Recommendations are made for the application of magnesia, and the merits of fertilizer materials and soil amendments supplying it are indicated.

Cigars from untreated plants burned with a coal black ash but held fire fairly well, those from plants supplied with calcium carbonate at the rate of 5 tons per acre burned with a very dark gray ash and a narrow coal band and did not hold fire quite so well, and cigars from plants treated with 1.8 tons of magnesium carbonate burned with a snow white ash and a very narrow coal band and held fire very poorly. The percentage of calcium in the leaf was almost doubled by the calcium carbonate treatment, and the magnesium carbonate applied increased the magnesia content of the leaves by 800 per cent, although reducing the potash in the leaf to less than 3 per cent, a deficiency accounting for the very low fire-holding capacity.

Effect of topping and suckering on development of the tobacco plant, T. Berthold (pp. 399–405).—Topping and suckering were found to promote the development of the root system and to aid growth of the leaves. Topping was more effective than suckering on the development of the root system; suckering resulted chiefly in the better development of the net of fibrous roots. Both practices were found to accelerate the ripening of the leaves. The leaves of plants topped early began to ripen earlier than those on late-topped plants. The leaves of untreated plants wilted most and those of low-topped suckered plants wilted least on hot days.

Influence of plant trimming on weight of the seeds, T. Berthold (pp. 406–410).—Pruning the inflorescence down to a smaller number of pods and also leaving some of the upper leaves on the stalk until the pods were entirely mature resulted in increase in the weight of seeds. The pods in the center of the inflorescence produced the heavier seeds. For production of heavy seeds about 20 to 25 of these pods should be left and all others trimmed off soon after the first flowers fade.

Curing experiments, O. E. Street (pp. 411–418).—Conclusions from these studies have been noted (E. S. R., 64, p. 834).

Tobacco insect studies in 1930, D. S. Lacroix (pp. 419–431).—Entomological studies, including a survey of insects that attack tobacco, insecticide tests, and miscellaneous observations are detailed on p. 356.

Fertilizer losses through leaching as measured by lysimeter experiments, M. F. Morgan, O. E. Street, and H. G. M. Jacobson (pp. 432–441).—Lysimeter experiments were made with the surface soil (7 in.) of 4 soil types treated with sodium nitrate, ammonium sulfate, urea, and cottonseed meal, and also with the surface soil and subsoil of Merrimac sandy loam treated with 15 nitrogen fertilizers and cropped with single tobacco plants. Tables show for the 18 months ended November 25, 1930, the nitrate nitrogen and basic constituents

leached from both types of cylinders, nitrogen leached as ammonium salts, nitrogen removed by the 1930 tobacco crop, and the leachings of bicarbonates, sulfur, manganese, and aluminum from the surface soil tanks and their relationship to the reaction of the leachate.

The use of coke in heating tobacco sheds, J. S. OWENS (pp. 442–444).—For heating tobacco sheds more than 40 per cent of the fuel cost was saved by using coke instead of charcoal. With 14-in. salamanders fitted with large mesh grates attention was needed only every 4 to 8 hours, while charcoal fires needed replenishing at periods ranging from 20 minutes to 1 hour. Coke gave a steady, practically odorless and smokeless heat which, with suitable salamanders and spreaders, was well distributed, and no trace of objectionable odor or injurious effect upon the tobacco appeared. Charcoal fires, however, were more flexible, being easier to start and to regulate than coke fires.

Fire-curing tests on stalk tobacco, J. S. OWENS (pp. 445, 446).—Experience of growers in fire-curing stalk tobacco in 1928 and 1929 is reviewed, and comparative tests on farms in 1930 are described. Changes in quality due to firing were neither consistent nor large.

[*Tobacco research in Massachusetts*], A. B. BEAUMONT, G. ROHDE, M. E. SNELL, J. B. LINDSEY, E. B. HOLLAND, and E. BENNETT (*Massachusetts Sta. Bul. 271 (1931), pp. 238, 239, 269, 270*).—Further evidence (E. S. R., 63, p. 523) showed that nitrogen as nitrates is better assimilated than as ammonia, urea, and certain organic forms, this nutritive relation prevailing when the entire growing period of the plant is considered. Field comparisons of rates of nitrogen with phosphorus and potassium constant indicated from 100 to 150 lbs. of nitrogen for maximum tobacco yields under Massachusetts conditions. Of the nitrogen carriers ammonium sulfate produced more tobacco than sodium nitrate, cottonseed meal, or the regular mixture containing several nitrogen forms. Of particular interest in view of results of previous years and other experiments, yields were slightly larger from plats having one year of timothy before tobacco than from plats in tobacco the previous year. The animal husbandry rotation appeared unsuitable for tobacco, producing symptoms of brown root rot.

Small scale tests showed two complete fertilizers to fail to produce normal tobacco on very acid soil without lime; good yields when the potassium in the regular tobacco fertilizer was supplied in ground tobacco stems; slight increases from colloidal phosphate at rates of 0.5 to 1 ton per acre besides the regular fertilizer; Milorganite to be a good substitute for cottonseed meal; and fertilizer in the row to outyield slightly an equal quantity broadcasted.

Analyses of the several grades of Havana tobacco grown on station plats under different fertilizer and cultural treatments revealed that the percentage of total, soluble, and amido nitrogen increased in the several grades from the base of the plant upwards. The nicotine increased from the base of the stalk up to the light or medium wrappers, and the acid soluble and insoluble ash decreased. Low topping resulted in higher percentages of total and soluble nitrogen, nicotine, and acidity in the seconds and reduced the acid soluble and insoluble ash. The percentage of total, soluble, and ammoniacal nitrogen, acid soluble ash, and acidity decreased, while nicotine and insoluble ash increased with maturity in seconds and darks. A heavier application of nitrogen increased total nitrogen, soluble nitrogen, and acid soluble ash within narrow limits, as a whole affecting the yield and size of leaf rather than composition. Sodium nitrate and ammonium sulfate increased the total nitrogen in the seconds more than did regular tobacco fertilizer or cottonseed meal. Nitrate nitrogen and nicotine were low on cottonseed meal plats. Ammonium sulfate

increased acidity and sodium nitrate resulted in the least acidity. Timothy in the rotation increased the percentages of soluble and ammoniacal nitrogen, nicotine, and acidity and reduced the percentage of acid soluble ash. Continuous tobacco had slightly higher percentages of total, soluble, and ammoniacal nitrogen and acid soluble ash and higher pH than tobacco following onions or potatoes.

Growth habit and yield in wheat as influenced by time of seeding, B. B. Bayles and J. F. Martin (*Jour. Agr. Research [U. S.], 42 (1931), No. 8, pp. 483–500, figs. 4*).—Variety-date of seeding experiments at the Sherman County, Oreg., Substation in cooperation with the U. S. Department of Agriculture demonstrated that the date on which wheats will head depends on variety, date of sowing, and seasonal environmental factors. Every wheat variety carrying a factor for winter growth habit if sown after its characteristic critical spring date will not head the same season but will produce a prostrate excessive vegetative growth and if not injured by drought or winterkilled will head the second season at about the normal date. Varieties seeded on the same date varied widely in date of heading. It was noted that varieties headed in the same relative order for comparable seeding dates during different seasons, although the actual heading dates varied with the season. Some wheats varied in relative order of heading for different seeding dates during the same season.

The critical sowing date for yield appeared to be earlier than that for heading. For normal heading the critical planting date was as early as February 15 for Hybrid 128, but for Federation was not reached until April 30. There was a range from Hybrid 128 with the earliest critical date to Marquis and Hard Federation which appeared to have none, heading when sown at any time if moisture and temperature favor growth. Critical dates are earlier in years with early growing seasons and higher temperatures than in years when the reverse obtains.

North Dakota weeds, O. A. Stevens (*North Dakota Sta. Bul. 243 (1930), pp. 58, figs. 59*).—This is a second revision of Bulletin 162 (E. S. R., 48, p. 136).

Manual of Ohio weeds, H. A. Runnels and J. H. Schaffner (*Ohio Sta. Bul. 475 (1931), pp. 166, figs. 34*).—This weed manual comprises a key to the species of Ohio weeds based on vegetative characters, descriptions of Ohio weeds with notes on habitat and control, discussions of methods of dissemination and of dormancy and longevity of weed seeds, classification of weeds according to life cycle, control methods for weeds in general and for field garlic, quack grass, bindweeds, Canada thistle, and dandelion, lists of the common weed impurities of seed of major crops, texts of the seed law and weed law of Ohio, a glossary, and an index.

HORTICULTURE

[Horticulture at the Massachusetts Station] (*Massachusetts Sta. Bul. 271 (1931), pp. 237, 238, 246–248, 250, 251, 264, 265, 274–278, 281–283*).—The value of calcium in the nutrition of the onion was observed by A. B. Beaumont and M. E. Snell who recorded a progressive increase in yield from applications in 1925 of from 2 to 6 tons of limestone per acre. Where lime was used in moderate amounts there was an indication that more frequent applications are desirable. Superphosphate applied as a substitute for part of the lime did not prove satisfactory either in effectiveness or in economy. In the old fertilizer ratio series the 4–12–8 mixture was found inferior to the 4–8–4 and about equal to the 4–8–6. Analyzing the results obtained over a 6-year period, it is concluded that a fertilizer high in phosphorus and potash is needed during the first few years of onion growing but that after a time cumulative effects appear.

Onion sets of medium size, 0.5 to 0.75 in. in diameter, gave better yields than larger or smaller sets and produced much fewer flower stalks than did the larger sets.

As reported by L. H. Jones, gladiolus corms which had been held in cold storage and planted in the greenhouse on August 21 and September 11 benefited by supplemental light; in fact, with the September planting no flower spikes were produced in the ordinary daylight series. It made no material difference whether overhead or side lighting was used. A cold storage temperature of about 38° F. was most successful. Corms were held successfully for 2 years, and positive blooming results were obtained after three winters and two summers in storage.

As determined by A. V. Osmun, Vitaglass failed to prove consistently better than ordinary glass in the production of radishes and lettuce.

The incorporation of paper mulch in the soil in which tomato seedlings were growing produced, according to Jones, unfavorable results, due apparently to nitrogen starvation brought about by the decomposing cellulose. Where paper pots were protected from decomposition no harmful effects were observed.

Jones and H. D. Haskins, observing that snapdragons growing in sandy subsoil mixed with manure and lime became chlorotic, found the soil highly alkaline, pH 7.9. Treatment of the soil with dilute sulfuric acid, followed by clear water and refertilizing with a complete mixture gave good results. In the absence of acid treatment fertilizers were ineffectual. The iron of ferric chloride was not assimilable. Stocks did well under lime conditions that injured snapdragons.

Cranberry investigations conducted by H. J. Franklin showed the need of ample water for this plant. Applications of 2 in. of water per week during the drought resulted in approximately 50 per cent more fruit of considerably larger size and better color. In studies of varieties he observed that productive and disease-resistant varieties rarely developed berries with more than four locules. Disease resistance and production were apparently intimately related. Resistance to one disease implied general resistance. The presence of only a few small seeds was sufficient. The development of wax on the berries appeared to tax the plant's vigor. High sugar, pectin, and excessive vine growth apparently were undesirable. The pH value of fruit of a large number of varieties was found to be about 2.6 during the harvest season. Blueberries with comparatively few seeds in relation to size of berry were desirable.

Some indication was obtained by H. E. White at the Waltham Field Station that manure and superphosphate, manure and peat, or superphosphate and peat were desirable nutrient combinations for the carnation and the rose. Certain rust-resistant snapdragons obtained from the Indiana Station withstood disease which eliminated ordinary varieties.

As reported by J. K. Shaw and J. S. Bailey, certain of the East Malling rootstocks have a very decided effect on the growth of McIntosh and Wealthy apple trees. As observed by Bailey in peach breeding studies reniform glands are dominant, glandular recessive, and globose glands intermediate. White flesh was dominant to yellow. Belle was a heterozygous white. Hale, Chile, Gold Drop, Crosby, Fitzgerald, and Elberta appeared homozygous for ripening date, with Belle and Champion heterozygous. Vainqueur, Greensboro, and Carmen seemed to transmit earliness. A character for very tough flesh appeared in the selfed progeny of Champion and Belle. In relation to freezing injury the length of exposure and previous exposures to high or low temperatures seemed to be important factors.

As reported by Shaw, pruning of bearing apple trees may be rather secondary to soil management and spraying. As observed by W. L. Cutler with old bear-

ing apples, light pruning was apparently more desirable than no pruning. Concerning methods of soil management Shaw reports the highest yields from cultivated trees receiving nitrogen, but the color was not as good as in the sod-nitrogen trees. In sod plat studies the N–P–K plats continued to yield the most fruit. Determinations of nitrates under white clover failed to show more nitrate than under adjoining grass. Comparisons of 10, 17.5, and 25 lbs. of nitrate of soda per tree for apples showed no yield differences, but some color variation. Comparing heavy mulch and cultivation, both without fertilizer, for pears and apples the results favored the mulch. In studies of lime and potash nutrition Shaw found magnesium-free calcium carbonate to be as effective as when magnesium sulfate was added. The pH 4.75 noted was too acid for the best growth of fruit plants.

Among desirable fruits observed in general variety tests by Shaw and O. C. Roberts were the Ideal peach, Newburgh raspberry, and Macoun apple. As reported by B. D. Drain leaf area was much larger on lightly pruned than severely pruned grapevines. McIntosh, according to F. C. Sears and Roberts, is practically self-sterile but a good pollinizer for other varieties. Wealthy, Oldenburg, Delicious, Ben Davis, and Cortland were good pollinizers for McIntosh. Light pruning of Northern Spy was found desirable by Roberts.

Results of variety tests of vegetables at the Waltham Field Station by P. W. Dempsey are reported. More stalks per plant were recorded on asparagus set 2 in. deep than at greater depths. The Bel-May lettuce was again found promising by V. A. Tiedjens.

Spraying investigations, T. J. Talbert and H. G. Swartwout (*Missouri Sta. Bul. 301 (1931), pp. 16, figs. 5*).—Experiments with oil sprays carried on since 1923 showed them to be valuable as dormant, delayed dormant, and summer applications. White oil emulsions gave promise as substitutes for arsenicals late in the season. Dry lime sulfur is deemed of doubtful value for controlling San Jose scale, but is considered an effective substitute for the liquid in summer sprays on apples. Bordeaux mixture in concentrations as low as 2–4–100 gave good control of fungus diseases and caused less injury than more concentrated mixtures. Where insects or diseases, or both, were serious, liquids gave better control than did dusts, which, however, are considered valuable supplements for sprays.

On the sour cherry lime sulfur is deemed more desirable than Bordeaux mixture, since the latter dwarfs the fruits and leaves an objectionable residue. Bordeaux mixture was, however, more effective than lime sulfur in controlling leaf spot. Ammoniacal copper carbonate was not as effective as Bordeaux mixture for spraying grapes and was more liable to cause burning, but had some value as a late spray because it left no stain on the berries. With apples and peaches spreaders did not give enough better results to justify their use.

Acidity and color changes in tomatoes under various storage temperatures, E. S. Haber (*Iowa State Col. Jour. Sci., 5 (1931), No. 3, pp. 171–184*).—Studies at the Iowa Experiment Station of the changes occurring in tomatoes stored at 36°, 50°, and 70° F. showed the 50° temperature to be the most satisfactory from the viewpoint of keeping and of retention of flavor. Fruits at 50°, either red ripe or green ripe, kept much better than at either the lower or higher temperatures and stood up better upon removal from storage. At the lower temperature green ripe tomatoes failed to color satisfactorily, and the full ripe fruits lost their original attractive red. The loss in weight and in acidity was very rapid at 70°, and although the least loss in acidity and weight occurred at 36°, this fact was offset by a failure to retain or develop satisfactory flavor.

Progress of orchard windbreaks, F. P. Eshbaugh (*[Oklahoma] Panhandle Sta., Panhandle Bul. 27 (1931), pp. 6–10, fig. 1*).—Brief notes are presented on the results of a windbreak experiment started in 1928 (E. S. R., 63, p. 238). In 1930 apricot made the greatest growth, while in 1931 Chinese elm led. Protecting young jack pines with shingles aided them greatly during their first year.

Significance of the probable error as applied to field experiments with apple trees, G. F. Potter (*Amer. Soc. Hort. Sci. Proc., 27 (1930), pp. 534, 535; also New Hampshire Sta. Sci. Contrib. [31] [1930], pp. 534, 535*).—Attention is directed to the fact that if uncontrolled fluctuating factors play a part, a considerable number of observations must be made to determine the true mean with any degree of accuracy. For example, to measure adequately the variation due to soil heterogeneity a considerable number of plats receiving the same treatment but scattered at random over the entire experimental area are needed. The readings should be so made that all sources of variability which enter into the experiment as a whole may affect each of the successive observations upon which standard deviation is based.

Comparative growth characteristics of the Baldwin and McIntosh apples, G. F. Potter and E. H. Putnam (*Amer. Soc. Hort. Sci. Proc., 27 (1930), pp. 265–270, figs. 3; also New Hampshire Sta. Sci. Contrib. [32] [1930], pp. 265–270, figs. 3*).—Working in New Hampshire with the Baldwin, a distinctly biennial apple, and the McIntosh, a fairly regular variety, statistical records were obtained upon the growth and blossoming performance of representative 6-year-old branches. The two varieties were remarkably similar as to the amounts and variability of growth of both twigs and spurs. Each year the McIntosh consistently formed a larger number of growths under 3 in. than did the Baldwin, and a much higher percentage of McIntosh spurs bloomed successively. With the McIntosh 17.3 per cent of the bloom was on spurs in their second year of growth as compared with 6.2 per cent in Baldwin. The McIntosh formed more spurs, but a higher percentage blossomed so that the number of vegetative spurs was practically equal in both varieties. In McIntosh the most profuse bloom occurred on spurs making 0.25 to 0.5 in. annual growth and in Baldwin on spurs making 0.5 to 0.87 in. Length for length, secondary shoots on fruiting spurs did not bloom as profusely as vegetative growths in McIntosh, while in Baldwin these secondary growths bloomed little or not at all. Short spurs, 0.125 to 0.25 in., were distinctly less fruitful in Baldwin than in McIntosh. Successive bearing in McIntosh was the result of alternate bearing of different spurs and of successive bloom on the same spurs, whereas in Baldwin successive bearing was only by alternation. On 96 McIntosh branches there have been 62.5 per cent of possible annual bearing as compared with only 13 per cent on 100 Baldwin branches.

Pollination studies with the McIntosh apple in New Hampshire, L. P. Latimer (*Amer. Soc. Hort. Sci. Proc., 27 (1930), pp. 386–396, figs. 2; also New Hampshire Sta. Sci. Contrib. 29 [1930], pp. 386–396, figs. 2*).—Cross-pollination experiments at the station upon McIntosh trees inclosed in wire screen cages and grown under a variety of cultural treatments showed during a period of years that Delicious is the most reliable and consistent pollinizer for McIntosh, irrespective of culture employed. Wagener competed closely with Delicious, but McIntosh, Gravenstein, and Baldwin pollen did not give good results.

Reciprocal experiments in which McIntosh pollen was applied to Cortland, Delicious, and Gravenstein stigmas indicated that McIntosh is a highly effective pollinizer for Cortland, good for Gravenstein, and fair for Delicious. Restricting the number of pollinated McIntosh blossoms per spur to one or two increased

the percentage of flowers to set fruit but reduced the number of spurs that set, apparently by decreasing the chances for setting. A strong correlation was found between the number of seed and the weight of McIntosh apples. Good pollination is deemed to mean in addition to more apples larger and better shaped apples and larger profits.

Removal of spray residues from apples: A wax-solvent method, J. R. Neller (*Indus. and Engin. Chem., 23 (1931), No. 3, pp. 323–325*).—As previously indicated (E. S. R., 64, p. 636), a thorough cleaning could be obtained by first dipping the apples in certain wax solvents, preferably methanol, after which an unheated hydrochloric acid wash dissolved and removed practically all the lead arsenate residue.

Cranberry growing in New Jersey, C. S. Beckwith (*New Jersey Stas. Circ. 246 (1931), pp. 40, figs. 28*).—A comprehensive discussion of the various features of cranberry growing, notably the selection of varieties, of soils, preparation of the soil, planting, harvesting, storing and marketing, use of fertilizers, control of insects and diseases, frost protection, the construction and maintenance of water systems for flooding, etc.

The value of the European grape in breeding grapes for New York State, R. Wellington (*Amer. Soc. Hort. Sci. Proc., 27 (1930), pp. 416–421*).—With progenies grouped under the vinifera parent, data are presented on the number, hardiness, stamen characteristics, and quality of the seedlings obtained in a large number of crosses and selfs made at the New York State Experiment Station. Varieties with upright stamens when intercrossed generally yielded about 25 per cent of reflexed stamen seedlings. However, Muscat Hamburg gave no reflexed seedlings and Chasselas Rose only a few.

FORESTRY

A test of hypsometers on short trees, H. F. Morey (*Jour. Forestry, 29 (1931), No. 2, pp. 233–237*).—In studies conducted by the Allegheny Forest Experiment Station in oak stands in southern New Jersey, it was found that the Forest Service hypsometer and the Abney level were the best instruments for determining height. The Abney level was apparently the more accurate instrument and the hypsometer the more rapid, with the general advantage in favor of the Abney level.

A progress report on the differences in growth of spruce and pine on poor soil, L. J. Young (*Mich. Acad. Sci., Arts, and Letters, Papers, 14 (1930), pp. 291–295*).—Comparisons of the growth showed a marked superiority of Scotch pine in ability to thrive on low grade soils, this species making twice the growth of white pine or western yellow pine and nearly thrice that of Norway spruce.

Mulching nursery transplants, T. J. Starker (*Jour. Forestry, 29 (1931), No. 2, pp. 238–240*).—No merit was found in mulching Douglas fir seedlings if sufficient water was available to carry the plants through dry periods. Light colored mulches such as straw and veneer proved harmful.

The effect of defoliation on tamarack, S. A. Graham (*Jour. Forestry, 29 (1931), No. 2, pp. 199–206, figs. 3*).—Observing a surprising recovery in tamarack after repeated defoliation by insects, the author conducted a study in and near the Itasca State Park in Minnesota to determine the effects of defoliation on this species.

Complete defoliation killed the trees after three successive years, although two trees showed some life after four years of defoliation. Partial defoliation failed to kill even at 75 per cent intensity, but did result in a relatively gradual

reduction in growth increment. Defoliation reduced the size of needles in subsequent years. Complete defoliation affected root growth as well as top growth, but to a lesser degree. Certain of the trees responded to defoliation with a sharp increase in growth during the first year, but dropped off sharply thereafter.

French face experiments in turpentining, V. L. Harper (*Jour. Forestry, 29 (1931), No. 2, pp. 225–232, figs. 2*).—Results obtained over a 2-year period by the Southern Forest Experiment Station indicated some superiority of the French system of chipping over the American for small trees, especially in relation to the yield of gum and the rate of healing of the wounds. On young longleaf pines 5-in. French faces yielded 22 per cent more gum the first and 16 per cent more the second year than did 5-in. American faces. With a newly devised tool two French faces were chipped in approximately the same time as one American face. The narrower French faces healed more rapidly than the wide American faces.

Progress report of the Forest Taxation Inquiry.—Digest of State forest tax laws (*U. S. Dept. Agr., Forest Serv.,* [rev.], *Jan. 1, 1931, pp. [4]+39+[3]*).—This is a reissue of the report previously noted (E. S. R., 62, p. 342) and of a table showing selected provisions of the State forest tax laws (E. S. R., 63, p. 587).

DISEASES OF PLANTS

[Plant pathology at the Massachusetts Station] (*Massachusetts Sta. Bul. 271 (1931), pp. 241–246, 284*).—Continuing studies (E. S. R., 63, p. 541) on tobacco black root rot, W. L. Doran found that soil limed in 1923 continued in 1930 to have pH values favorable to infection. Neither alfalfa nor timothy was more effective than tobacco in lowering the pH value. On the other hand, soil acidity of limed plats was increased even after four years by sulfur, there being less black root rot on plats treated with sulfur in 1926 and 1927 than in untreated areas. Yields of tobacco from limed plats were 27 per cent less than from unlimed areas. Losses caused by lime applied in 1923 have been decreasing since 1925, and sulfur or acids proved less beneficial in 1930 than in earlier years. Sulfur applied to soil with a pH value of 7.1 lowered the pH to 6.5 but not enough to affect black root rot or the tobacco itself. Apparently factors other than pH are concerned in black root rot, since orthophosphoric acid sufficient to lower pH from 5.9 to 5.0 did not control the disease.

Studies on brown root rot of tobacco showed the beneficial effect of hay crops, such as alfalfa, timothy, and clover, on the next two or three tobacco crops. Applications of copper oxide, copper sulfate, copper acetate, lead sulfate, and lead acetate to the soil injured the tobacco.

Field surveys conducted by W. H. Davis, O. C. Boyd, and Doran showed that soil sterilization was practiced in 25 per cent of the tobacco seed beds and gave good results in superior plants and lower losses from disease in the field. Wildfire and mosaic were widely distributed.

Cooperating with A. I. Bourne, Doran found that Bordeaux mixture increased the yields of onions, whereas copper-lime dust did not affect yields. As determined by L. H. Jones, injury similar to blast could be induced in onions by exposure to intense sunshine and low relative humidity after a period of reduced light, increased relative humidity, and growth in wet soil.

Eggplant wilt studies by E. F. Guba showed that spores were rendered nonviable by treatment with aluminum sulfate, inoculated sulfur, and monohydrated copper-lime dust. Nutrient media acidulated with sulfuric acid completely inhibited growth at pH 3.7 and up to pH 4.5 retarded growth. Soil acidified with aluminum sulfate to a range of pH 4.7 to 5.0 showed no effect

upon the growth of eggplant. Below pH 4.7 growth became poorer as the pH value was decreased. Above pH 5.0 infection occurred. With inoculated sulfur, all of the plants were infected at a soil pH of 4.3, and one-third of them at pH 4.0. At pH 4.0 growth was fair, but at pH 3.5 to 3.6 the plants were killed. Field experiments failed to show that soil acidification could be used to control eggplant wilt, so that the plan of using old sod land for eggplants remained the only reliable method of control.

As reported by Doran, downy mildew of cucumbers appeared during the first two weeks of August over a period of six years. Oosporelike bodies failed to germinate or cause infection. Conidia produced on dewy nights did not survive the drying effects of the next day's sun. In the absence of rain, infection must occur rapidly. Greenhouse cucumbers were injured by dusting with sulfur but not by Bordeaux mixture, copper acetate, Pickering spray, or milk of lime. Inoculation of sprayed plants with suspensions of conidia caused no infection, whereas unsprayed leaves were all infected.

Adequate air circulation was found by Guba to lower the hazard of tomato leaf mold in the greenhouse. In old greenhouses not provided with sufficient ventilation, control of humidity was found highly important.

A mixture of equal parts by weight of calcium cyanide and paradichlorobenzene incorporated in the soil at the rate of 2,400 lbs. per acre in two applications one week apart was found by Jones to eradicate nematodes from greenhouse soil, but is not yet established as a commercial practice.

Carnation blight (*Alternaria dianthi*) was found by Guba to be unable to survive the second winter in the field, suggesting the desirability of a 2-year rotation. Among varieties, Matchless and related broad-leaved types were very susceptible. Losses in the greenhouse were influenced by the prevalence of the disease in the field, time of planting, methods of watering, temperature, etc. None of the various sprays and dusts tested for the control of blight in the field gave satifsactory control in 1930. Naphthalene control of red spider was found to be better than the watering method as concerned flower production.

As reported by C. V. Kightlinger, some of the strains of Havana tobacco developed by the Wisconsin Experiment Station for resistance to black root rot gave promise in the Connecticut Valley.

Some diseases of crops in the Andaman Islands, M. Mitra (*Agr. Research Inst., Pusa, Bul. 195 (1929), pp. 14*).—Brief accounts are given regarding coconut palm root disease (*Botryodiplodia* sp.), stem bleeding disease (*Thielaviopsis paradoxa*), bud rot (*Phytophthora palmivora*), nut fall (*Phytophthora* sp.), and leaf diseases associated with *Pestalozzia palmarum*, *Exosporium palmivorum*, and *Mycosphaerella* sp.; the Hevea leaf spot (*Helminthosporium heveae*), leaf rim blight (*Sphaerella heveae*), leaf spot (*Colletotrichum heveae*), root disease (*B. theobromae*), die-back (*B. theobromae*), pink disease (*Corticium salmonicolor*), black thread blight (*Phytophthora meadii*), and canker; Jack fruit mold (*Rhizopus artocarpi*); mango sooty mold (*Capnodium* sp.) and leaf spot (*Pestalozzia* sp.); mangosteen disease (die-back?); lime and orange anthracnose or wither tip (*Colletotrichum gloeosporioides*) and sooty mold (*Meliola butleri*); tea red rust (*Cephaleuros mycoidea*), gray blight (*P. theae*), brown blight (*Colletotrichum camelliae*), thread blight (sterile mycelium), and tea seed mold (*Penicillium* sp.; *Massarina usambarensis* and *Massaria* sp. also found); coffee rust (*Hemileia vastatrix*) and a disease resembling die-back (*Colletotrichum* sp. and *Hemileia* sp. suspected); plantain fruit rot or anthracnose (*Gloeosporium musarum*) and wilt (*Fusarium* sp.); sugarcane leaf spot (*Leptosphaeria sacchari*) and rind disease (*Melanconium sacchari*); tomato wilt (*F. lycopersici?*); and rice sclerotial disease (*Sclerotium oryzae*). An account is given of protective means, measures, and methods.

Report of the plant pathologist, H. A. PITTMAN (*West. Aust. Dept. Agr. Ann. Rpt. 1929, pp. 27–29*).—This first separate report of the plant pathologist's branch outlines activities and lists publications related to plant diseases.

As regards apple bitter pit development, resistance, and conditions, experimentation is noted as undertaken with the varieties Cleopatra, Jonathan, Dunn, and Granny Smith.

Principal diseases of the year as listed include wheat root rot (*Wojnowicia graminis*), foot rots (*Helminthosporium sativum* and *Fusarium* sp.), take-all (*Ophiobolus graminis*), bunt or stinking smut (*Tilletia laevis* and *T. tritici*), stem rust (*Puccinia graminis tritici*), flag smut (*Urocystis tritici*), and a poor setting of grain (drought, wind, and frost); oats loose smut (*Ustilago avenae*), covered smut (*U. laevis*), and take-all (*O. graminis*); barley covered smut (*U. hordei*); alfalfa rust (*Uromyces medicaginis*) and black spot (*Pseudopeziza medicaginis*); apple corking, bitter pit, surface scald, and mildew (*Podosphaera leucotricha*); pear scab (*Venturia pyrina*); stone fruits sour sap, shot hole and canker (*Clasterosporium carpophilum*); orange pitting (*Pseudomonas citriputeale*), Australian brown rot (*Phytophthora hibernalis*), crinkle (on navels), and collar rot; grape powdery mildew (*Uncinula necator*), brunnisure, and court noué; tomato eelworm (*Heterodera radicicola*), tomato spotted wilt, potato common scab (*Actinomyces scabies*), crucifer black rot (*Pseudomonas campestris*), cucurbit mildew (*Erysiphe cichoracearum*), swede dry rot (? *Phoma lingam*), pea root rot and spot (*Ascochyta pisi*), onion mildew (*Peronospora schleideni*), broad bean chocolate streak, edible pea nematode (*H. radicicola*), and Irish potato blight.

Phanerogamic parasites reported include dodder (*Cuscuta* sp.), *Bartsia trixago* and *B. viscosa* on clovers, broom rape (*Orobanche cernua*) being common on pasture plants generally in coastal districts. Diseases recorded for the first time in Western Australia include rust on subterranean clover (? *Uromyces* sp.), swede false club root (? *Olpidium radicicolum*), garden nasturtium (*Tropaeolum majus*) mosaic, swede dry rot (? *Phoma lingam*), brunnisure of grapevines, eelworms (*H. radicicola*) on roots of native boronia (*Boronia megastigma*), of *Ceinfugosia hakeifolia* and of *Cassia corymbosa*, and nutritional malformation of couch grass (*Cynodon dactylon*).

[Plant diseases, Nigeria], P. H. LAMB (*Nigeria Agr. Dept. Ann. Rpt. 1929, pp. 15, 16*).—This portion of the acting director's report indicates briefly a continued study of the bacterial diseases of cotton known as angular leaf spot (*Pseudomonas malvacearum*) and an inquiry into an obscure watery disease of yams.

Diseases of grain and their control, W. W. MACKIE (*California Sta. Bul. 511 (1931), pp. 87, figs. 46*).—A general discussion presenting descriptions of the various diseases of grain, with information on their life history and the best known methods of control and on the preparation and use of various control substances.

Inheritance of resistance to bunt, Tilletia tritici, in hybrids of White Federation and Banner Berkeley wheats, F. N. BRIGGS (*Jour. Agr. Research [U. S.], 42 (1931), No. 5, pp. 307–313, fig. 1*).—The author found that Banner Berkeley wheat differs from White Federation in one main factor for resistance to bunt. The factor concerned is believed to be identical with the one present in Martin, giving Banner Berkeley the genetic constitution of *MMhh* in respect to resistance. Since only one physiologic race of bunt (III) was used, the author concedes that there may be other factors for resistance to bunt in Martin, Hussar, White Odessa, and Banner Berkeley which would become apparent in the presence of other physiologic forms of bunt. If there are no other factors present, Martin, Banner Berkeley, and White Odessa should have

the same reaction to all forms of bunt. In breeding bunt-resistant wheats, it is believed immaterial whether Martin or Banner Berkeley be used as the resistant parent, since both have the same genetic constitution in respect to resistance.

Studies on the nature of rust resistance in wheat, I–III, IV, R. NEWTON ET AL. (*Canad. Jour. Research, 1 (1929), No. 1, pp. 5–35, 86–99, fig. 1*).—This contribution presents an account of work done during the first three years on the program of investigations which are outlined in the general introduction, following which the second, third, and fourth sections deal, respectively, with physicochemical properties of host cell contents, culture and injection experiments to demonstrate inhibiting or accessory substances, and phenolic compounds of the wheat plant.

Among eight wheat varieties differing widely as regards resistance to stem rust, no corresponding differences were found in the physicochemical properties of their expressed tissue fluids, though the infection rate of some susceptible varieties was reduced by administering extracts of resistant varieties in Petri dish cultures or by direct injection into inoculated leaves. No excretion of toxin by the fungus could be demonstrated. The injection of salicylic acid, catechol, or vanillin in certain concentrations frequently reduced infection, inhibiting the germination of rust spores. The growth of *Helminthosporium sativum* was stimulated by these solutions at low, but inhibited at higher concentrations. On filtered wheat juice, rust spores failed to germinate, though on unfiltered wheat juice they germinated normally.

In following up a suggestion that rust resistance in wheat may be due to the liberation of phenols in the host cells upon the entrance of the fungus, a tentative method was developed for determining the presence of such compounds in the press juice, including a critical study of the conditions for clarifying the juice with tungstic acid. The content of phenolic substances has been found to bear some relation to rust resistance. Yellow pigments of the flavone type are supposed to be the main phenolic compounds present.

Wheat black rust in Tunis [trans. title], C. CHABROLIN (*Dir. Gén. Agr., Com. et Colon. [Tunis], Bul., 33 (1929), No. 136, pp. 57–65*).—In Tunis during 1928, following the relatively humid spring months, black rust (*Puccinia graminis*) caused serious losses in wheat culture. This rust is said to develop here in the absence of both Berberis and Mahonia. Its severity bears a relation to the humidity which is apt to be high in March. As yet but little is known regarding varietal resistance.

Breeding winter wheat for resistance to stinking smut (Tilletia levis and Tilletia tritici), T. A. KIESSELBACH and A. ANDERSON (*Nebraska Sta. Research Bul. 51 (1930), pp. 22, fig. 1*).—Studies with several lines of hard red winter wheat isolated from the Turkey variety because of their resistance to both *T. laevis* and *T. tritici* showed them to be also resistant to black stem rust (*Puccinia graminis tritici*). When subjected to low temperatures, three of the strains were as cold resistant as Nebraska No. 60 and were more productive, yielding from 4.3 to 4.8 bu. more per acre. In the nursery the average yield from 10 replications ranged from 1.9 bu. less to 0.9 bu. more per acre than the parental variety.

Certain segregates of hybrids between standard susceptible and resistant varieties gave such favorable reactions to inoculation with various collections of smut that this method of obtaining new resistant lines is deemed promising. All collections of smut from Nebraska and other central States proved to be *T. laevis*.

Differential reactions of the new Turkey selections and of a number of hybrid selections and established resistant varieties to collections of bunt from a

number of States gave evidence of the existence of mild and virulent physiologic forms of both species. Certain selections proved so resistant to all collections that annual seed treatment of these is deemed unnecessary.

Studies in the wilt disease of cotton in the Bombay Karnatak, Series 1, G. S. Kulkarni and B. B. Mundkur (*India Dept. Agr. Mem., Bot. Ser., 17 (1928), No. 2, pp. 27, pls. 4*).—After an introductory statement by H. H. Mann, Kulkarni deals with The Parasitism of the Fusarium Associated with the Wilt Disease of Cotton and Kulkarni and Mundkur with The Pathogeny of Wilting in Cotton Plants.

General statements as to the extent and spread of the injury caused by cotton wilt associated with *Fusarium vasinfectum*, possibly other organisms, are followed by an account dealing with the history, characters, and identity of the associated organism, also the effects of its presence, activity, and relations in cotton filtrates.

The conclusion is reached, after consideration of the microscopic evidence, that the primary factor leading to the death of the cotton plants is not a clogging of the vascular ducts by the fungus mycelium.

The active factor causing wilt in cotton plants is supposed to be a chemical compound, or more than one, occurring in the liquid in which the fungus has grown, which is not destroyed by ordinary boiling or by autoclaving to from 110 to 115° C., and is not removable by filtration. The nature of the substance or substances has not been determined, but lactic and oxalic acids are definitely excluded and nitrates do not appear to be causal. The solutions in which the Fusarium had grown killed susceptible cottons, wilted resistant types, and often caused wilt symptoms in types considered as immune.

Studies on the flax rust, N. Hiratsuka (*Sapporo Nat. Hist. Soc. Trans., 10 (1928), No. 1, pp. 1-27*).—Flax rust (*Melampsora lini*), as now widely distributed throughout the flax-growing parts of Japan, is briefly described as affecting the stems, leaves, pods, and bracts. Varieties immune or very resistant include Ottawa 770 B, Williston Golden, and three strains of Argentine race.

Fungus diseases of potatoes, F. Weiss (*Potato Assoc. Amer. Proc., 15 (1928), pp. 285-290*).—A review is given of the literature (with 20 references) of potato diseases associated with *Synchytrium endobioticum*, *Phytophthora infestans*, *Fusarium coeruleum*, *F. viticola*, and *F. avenaceum* in different countries as regards varietal immunity or susceptibility in various or varying degrees.

Bacterial diseases [of potatoes], J. E. Kotila (*Potato Assoc. Amer. Proc., 15 (1928), pp. 290-292*).—A brief account is given of potato bacterial diseases indicated, with eight references dated 1926-1928.

Potato virus diseases, E. S. Schultz (*Potato Assoc. Amer. Proc., 15 (1928), pp. 293-296*).—A very brief review is given of 1927 and 1928 publications, 11 in number, bearing upon potato viruses, their hosts, and carriers.

The black leg disease of potatoes (Bacillus phytophthorus (Frank) Appel), D. J. MacLeod (*Canada Dept. Agr. Pamphlet 105, n. ser. (1929), pp. 10, pls. 3*).—Potato blackleg (*B. phytophthorus* (=*B. solanisaprus*, *B. atrosepticus*, or *B. melanogenes*)) is described and is discussed as to the spread of the disease, the predisposing conditions, and effective control measures, including the use of seed known to be healthy; sterilization of the cutting knife; disinfection by soaking for 2 hours in formalin (1 pint to 30 gal. of water) or for 1.5 hours in mercuric chloride (4 oz. to 25 gal. of water), preparing the seed potatoes previously in either case by soaking in clean water for 6 to 10 hours; avoidance of planting too early in cold and especially poorly drained soil; and avoidance of too long keeping or exposure of the cut seed before planting.

Infection experiments with spindle tuber and unmottled curly dwarf of the potato, R. W. Goss (*Nebraska Sta. Research Bul. 53 (1931), pp. 36*).—Results of experimental tests showed that grasshoppers, flea beetles, tarnished plant bugs, and the larvae of Colorado potato beetles could transmit both spindle tuber and unmottled curly dwarf. The leaf beetle transmitted spindle tuber but not unmottled curly dwarf, and the leafhopper failed to transmit spindle tuber. Nine collections of grasshoppers, 4 of tarnished plant bugs, and 2 of flea beetles were found to carry either the virus of spindle tuber or of unmottled curly dwarf. Grasshoppers and tarnished plant bugs were not found to transmit mild and rugose mosaic and leaf roll. The flea beetle failed to transmit leaf roll and mild mosaic. In general, the percentage of infection increased with the number of insects used for the inoculation and with repeated inoculations with a few insects. Inoculations with the saliva or an extract from the stomach of grasshoppers that had fed on infected plants failed to convey the diseases.

Interspecific inoculations between spindle tuber and unmottled curly dwarf potatoes and a number of other solanaceous plants all gave negative results.

As indicated in cross inoculations to several solanums, the virus of masked mosaic of apparently healthy potatoes occurred also in spindle tuber and unmottled curly dwarf plants. No mosaic symptoms appeared on inoculation back to healthy plants.

With artificial inoculations the percentage of infection was increased by increasing the amount of inoculum. The rate of development of symptoms was correlated with the time of inoculation. Both diseases were transmitted by seed-piece contact and by the cutting knife. A treatment of seed pieces with organic mercury immediately after cutting was effective, but not so six hours later. Holding the seed pieces from 15 to 24 hours before planting decreased the amount of infection. Moist soil tended to increase the disease on inoculated seed pieces. Although picker planters apparently could transmit the disease, it is not deemed likely that they are important factors except when the tubers are badly infected. Spindle tuber virus did not spread or diffuse through the tuber in storage as a result of seed-piece plug inoculations. Spindle tuber virus withstood greater dilution than did unmottled curly dwarf. The thermal death point of the virus in the juice of unmottled curly dwarf plants was between 75 and 85° C. (167 to 185° F.).

The mosaic disease of beets, L. K. Jones (*Washington Col. Sta. Bul. 250 (1931), pp. 16, figs. 4*).—A study was made of the distribution, symptoms, and manner of spread of a mosaic disease which has greatly reduced the yield of seed of beet plantings in western Washington. The symptoms differed widely under various light and temperature conditions. In general, plants grown at 50° F. showed very indefinite symptoms, while at 70° the markings were very distinct. Infected plants matured almost a month earlier than healthy plants.

Attempts to transmit the disease by placing juice of infected plants into wounds on healthy plants were ineffectual, but when aphids from mosaic beets were transferred infection was complete. No evidence was obtained that insects other than aphids were concerned in transmission.

The disease was found to overwinter in the mother beets stored in pits but not in the soil. The author recommends that beets be seeded at least 100 yds. from mother beets and even farther, since transmission was noted 1.5 miles from infected plantings. Spread was most rapid during the latter part of the summer when aphids were most abundant.

The gummosis of sugar cane, M. T. Cook (*Jour. Dept. Agr. Porto Rico, 12 (1928), No. 3, pp. 143–179, pls. 5*).—Sugarcane gummosis, a bacterial disease caused by *Bacterium vascularum*, which lives in the tracheary tissues of the

fibrovascular bundles, sometimes dissolving the cell walls and spreading into the surrounding tissues of susceptible canes and into young tissues of somewhat resistant canes and producing a gum which oozes out of the cut ends of the infected canes, kills many young canes and reduces yield to degrees varying with the susceptibility of the variety and the severity of the attack. The gum also interferes with the crystallization of the sugar in the mills. The infection percentage is higher on plant than on ratoon cane, but in all cases observed the yield on the ratoons was reduced. The leaf symptoms are more pronounced during wet than during dry weather. Immune or highly resistant varieties should be used in Porto Rico, and since many of the best varieties there are immune or highly resistant, the disease is not necessarily a serious problem. Infected canes should never be used for commercial planting.

Sugarcane pokkah boeng and twisted top in Cuba [trans. title], C. N. Priode (*Rev. Agr. Puerto Rico, 23 (1929), No. 2, pp. 60–69, 94, 95, pl. 1, figs. 11*).— Sugarcane pokkah boeng and twisted top are represented as distinct. The former, considered very infectious, is very similar to the disease of like name in Java caused by *Fusarium moniliforme*. Twisted top (Cogollo retorcido) is thought to be noninfectious and probably identical with the disorder called pokkah boeng reported from Hawaii. It is thought to be due to simple mechanical stem friction.

Life history of Ligniera vascularum (Matz) Cook, M. T. Cook (*Jour. Dept. Agr. Porto Rico, 13 (1929), No. 1, pp. 19–29, pls. 4*).—This organism, indicated as the cause of a sugarcane disease in Porto Rico and described in 1920 under the name *Plasmodiophora vascularum*, has not, it is said, been reported from any other part of the world. The present paper is a record of studies on the life history of the organism which have resulted in its transfer from Plasmodiophora to Ligniera.

It lives primarily in the tracheary tissues of the sugarcane but occasionally spreads to surrounding tissues. It causes a disease of sugarcane known locally as dry top rot.

The life history is very similar to that of *P. brassicae* and other species which have been placed in the genus Ligniera by writers named.

Sweet potato disease control, C. Lyle (*Tenn. State Hort. Soc. [etc.] Proc., 25 (1930), pp. 57–61*).—In Mississippi, stem rot and black rot constitute threatening or leading sweetpotato problems. Stem rot, as described, causes its heaviest losses on light, sandy, rather poor soils in which it may overwinter, as in the stored roots. Black rot also overwinters in soil and spreads in storage. The only other severe rot in the South is soft rot or ring rot associated with the bread mold fungus which may appear anywhere, though it affects only bruised potatoes and is thus kept down by careful handling. Sweetpotatoes are much more easily bruised than are apples.

Suggestions for control of stem and black rot include seed selection, seed disinfection, care in bedding, removal of diseased plants, crop rotation, use of vine cuttings on new land, and use of resistant varieties, in case of soft rot, as no varieties are resistant to black rot.

The black-shank of tobacco in Porto Rico, J. A. B. Nolla (*Jour. Dept. Agr. Porto Rico, 12 (1928), No. 4, pp. 185–215, pls. 6*).—A tobacco disease, known in Porto Rico as "pata-prieta" and supposedly the same as the black shank in the southern United States and the "lanas" or "bibit" of the Dutch East Indies, has been destructive in Porto Rico during the last few years on tobacco. The pathogene attacks also *Ricinus communis*, potato plants, pepper, tomato, and eggplant seedlings under certain conditions locally. A noncommercial tobacco (mammoth type) proved to be the most susceptible of all varieties,

and all the cigar-filler varieties appear slightly susceptible. Of the two important commercial cigar-wrapper varieties in Porto Rico, one was found to be susceptible and the other very resistant. New strains of a Porto Rican variety of cigar-wrapper tobacco have shown high resistance.

First-generation populations of crosses between a very susceptible variety and other susceptible or slightly resistant types were very susceptible. On the other hand, crosses of resistant varieties with susceptible were more resistant than was the susceptible parent. The symptoms are produced on plants of all ages. A bed rot and seedling blight, a rotting of transplants, a blackening of the basal parts of the stems of plants of all ages, and a leaf spot on big plants are the most important morphological phases. A severe rotting of seedlings in the seed beds was also produced, as was a disease of transplants called "hinchado" (water soaked or swollen). The cause is here given as *Phytophthora nicotianae*. The organism from Porto Rico appears to be morphologically different from that of Florida, and is, therefore, considered a different strain, although they do not differ essentially in cultural characteristics or in pathogenicity. The Porto Rico and the Florida strains were not compared culturally or morphologically with the strain from Sumatra. Chlamydospores size is of no value in the separation of the strains, use being made only of the size of sporangia.

Moisture is a dominant factor as regards the outbreaks of damping-off caused by the black-shank pathogene. Irrigation water is an important agent in the transportation of the organism from one field to the other. *P. nicotianae* lives in the soil as a saprophyte on plant debris, old tobacco stems, or manure.

Control measures recommended include the removal of diseased plants, rigid selection of seedlings before setting, dipping of healthy seedlings from a diseased bed in a 4-4-50 or a 5-5-50 Bordeaux mixture before transplanting, and the selection and breeding of resistant varieties. Soil treatment with Bordeaux mixture was not effective as a preventive.

Tomato diseases [in Tennessee], S. H. Essary (*Tenn. State Hort. Soc. [etc.] Proc., 25 (1930), pp. 93-96*).—Of the large number of tomato diseases, there are considered in the present paper wilt or blight and leaf spot, both of which have attracted much attention because of great losses caused by them.

Wilt, known in Tennessee probably for 50 years or more, exists over all parts of the State, especially where tomatoes have been grown for some time. The organism, a fungus which may be in the soil, enters via the roots. The most resistant varieties fail on heavily infested soils. The seed are not known to carry the fungus. The use of clean beds and new fields offers the best protection. Rotation is essential. One planting in tomatoes within 4 years is thought to be about the limit of safety.

Leaf spot is due to one or two common fungi, either of which may live on related plants or in the soil. The more common of these also causes the early blight of potatoes. It may appear in the plant bed and so be carried to the planting field. The second (*Septoria* sp.) appears later, frequently in the plant bed where the temperature is high. The results are about the same for each fungus and the diseases are often confused. The leaves may be cast, the stem ringed, and the plant killed without ripening a full crop. Leaf spot and wilt require practically identical measures for control. Bordeaux mixture is recommended. Spraying with this afforded adequate protection when used once thoroughly on the plant bed and once on the plants after setting, but further spraying reduced the yield.

New points on fire blight control, J. A. McClintock (*Tenn. State Hort. Soc. [etc.] Proc., 25 (1930), pp. 32-37*).—An account, with description, is given of the results of tests to determine the fire blight resistance of pomaceous

fruit varieties. While some highly resistant varieties of pears have been obtained, none of these varieties are sufficiently desirable commercially for recommendation to growers. Similar work is already under way with apples and quinces.

Regarding the present problem, that of reducing blight in orchards already established, it has been ascertained that the fire blight organism overwinters much more in the pear than in the apple trees. Among these, Yellow Transparent is one of the worst in respect to overwintering, only the occasional Transcendent crab probably being worse.

Primary blossom infections are more often caused by rain than by other agents. The action of bees in carrying infection is secondary, and these insects are needed for the work of pollination.

As to sucking insects, these are said to be absent at the time when most of the infections occur, and they could not, it is thought, cause all of the early-appearing infections.

Removal of infected parts so as to leave only wood known to be sound, disinfection with 1 : 1,000 mercuric chloride, and coating with grafting wax or thick paint are measures approved for control.

Spraying apple and pear trees [trans. title], E. Johansson (*Meddel. Perm. Kom. Fruktodlingsförsök* [*Sweden*], *No. 17* (*1929*), *pp. 7, figs. 2*).—Tabulations and discussion are given of 1928 tests against scab on apple and pear trees.

A new rust fungus attacking Tennessee apples, J. A. McClintock (*Tenn. State Hort. Soc.* [*etc.*] *Proc., 25* (*1930*), *pp. 43–46, figs. 2*).—A brief account is given of a rust disease attacking most seriously the apples Red Delicious, Red Winesap, and Stayman Winesap, which are not ordinarily attacked by the common cedar rust. Study of the organism showed it to be probably *Gymnosporangium germinale*, the cause of quince rust.

Sporotrichum fruit spot of apple, M. W. Gardner (*Phytopathology, 18* (*1928*), *No. 1, p. 145*).—A shallow surface spotting, which is described, was found on Grimes, Ben Davis, and Winesap apples grown in southern Indiana when the fruit was removed from cold storage. Constantly associated with this condition is a fungus closely resembling or identical with *S. malorum*, an abundance of mycelium and spores forming in the rotted tissues and the organism being readily isolated in pure culture. Inoculation tests show that the mycelium can invade the uninjured fruit and produce small lesions around the lenticels.

Fruit spoilage diseases of figs, R. E. Smith and H. N. Hansen (*California Sta. Bul. 506* (*1931*), *pp. 84, figs. 47*).—Presenting a general discussion of the fig-producing situation in California and of caprification and the opportunity that it offers for the transfer of disease, the authors discuss the various fig diseases, namely, souring, splitting, mold, sunburn, smut, spotting, and endosepsis, and outline methods of control. Endosepsis, caused by *Fusarium moniliforme fici*, almost universally present in caprifigs and transferred into the edible figs by the Blastophaga insect, receives particular consideration, and a procedure for cleaning up the disease is outlined in considerable detail.

Treatment for citrus gummosis [trans. title], J. de Campos Novaes (*Bol. Agr.* [*Sao Paulo*], *29. ser., 1928, No. 11–12, pp. 684–689, figs. 5*).—Citrus gummosis, attributed to *Pythiacystis citrophthora*, is here discussed regarding its relation to other fungi and its treatment with Bordeaux paste.

Thread blights and pink disease on coffee [trans. title], W. Bally (*Arch. Koffie Cult. Nederland. Indië, 3* (*1929*), *No. 1, pp. 24, pls. 2, figs. 11; Eng. abs., p. 22; also Meded. Proefsta. Malang, No. 67* [*1929*], *pp. 24, pls. 2, figs. 11; Eng. abs., p. 22*).—An account is given of fungi causing coffee thread blights, also of pink disease, with a view to early and effective control.

Development of brown canker of roses, A. E. Jenkins (*Jour. Agr. Research [U. S.], 42 (1931), No. 5, pp. 293–299, pl. 1, figs. 4*).—This paper presents data pertaining to the development of brown canker (*Diaporthe umbrina*) on the stems, leaves, and flowers of garden roses, with a view to aiding in the identification of the disease. No evidence of initial infection was found on current-year stems until early in August. In the vicinity of Washington, D. C., the perfect stage of the fungus may be found during the entire year. The leaf spot caused by brown canker is said to be difficult to distinguish from other rose leaf spots.

Diseases of ornamental plants, R. P. White (*New Jersey Stas. Circ. 226 (1931), pp. 98, figs. 53*).—General information is presented on the nature and control of diseases of a large number of ornamental plants.

[Diseases of ornamental plants], R. P. White (*New Jersey Stas. Circs. 230 (1931), pp. 2, fig. 1; 231, pp. 4, figs. 2; 232, pp. 4, figs. 2; 233, pp. 2; 234, pp. 4, fig. 1; 235, pp. 7, figs. 7; 236, pp. 2, fig. 1; 237, pp. 4, figs. 6; 238, pp. 2, figs. 2; 239, pp. 7, figs. 4; 240, pp. 3, figs. 2; 241, pp. 11, figs. 9; 242, pp. 4, fig. 1; 243, pp. 4, figs. 3; 244, pp. 4, figs. 2; 245, pp. 2, fig. 1*).—The following repaged separates from Circular 226, noted above, are here included: No. 230, Diseases of Boxwood; No. 231, Diseases of Carnations; No. 232, Diseases of China Asters; No. 233, Diseases of Chrysanthemums; No. 234, Diseases of Delphinium or Larkspur; No. 235, Diseases of Gladiolus; No. 236, Diseases of Hollyhocks; No. 237, Diseases of Iris; No. 238, Diseases of Laurel; No. 239, Diseases of Peonies; No. 240, Diseases of Perennial and Annual Phlox; No. 241, Diseases of Roses; No. 242, Diseases of Snapdragons; No. 243, Diseases of Sweet Peas; No. 244, Diseases of Tulips; and No. 245, Winter Injury of Evergreens.

Elm disease, J. Westerdijk and C. Buisman (*De Iepenziekte. Arnhem: Nederland. Heidemaatschappij, [1929], pp. [4]+78, pls. 12, figs. 9; Ger. abs., pp. 66–76*).—This account comprises sections by the authors separately on phases, causation, organisms, and relations of elm disease, with a literature list of 39 titles.

ECONOMIC ZOOLOGY—ENTOMOLOGY

The fur seal of the California islands, with new descriptive and historical matter, C. H. Townsend (*Zoologica [New York], 9 (1931), No. 12, pp. 443–457, figs. 8*).—An account of *Arctocephalus townsendi* Merr., which reappeared in 1928 after a long absence from the California islands.

The quail of California, D. D. McLean (*Calif. State Div. Fish and Game, Game Bul. 2 (1930), pp. 47, pls. 7, figs. 10*).—This account deals with the painted quail (*Oreortyx picta picta* (Doug.)) and the mountain quail (*O. picta plumifera* (Gould) (pp. 7–14); the California quail (*Lophortyx californica californica* (Shaw)), valley quail (*L. californica vallicola* (Ridgway)), Catalina Island quail (*L. californica catalinensis* (Grinnell)), the Spring Valley survey, the valley quail family as game birds, and the food of valley quail (pp. 14–35); Diseases and Parasites of the Valley Quail, by E. C. O'Roke (pp. 35–37); Gambel or desert quail (*L. gambeli* (Gambel)) (pp. 37–44); and a bibliography of 33 titles (pp. 45, 46). The introduction of these quail into other States and countries is considered in each case.

The birds of Nyasaland, C. F. Belcher (*London: Crosby Lockwood & Son, 1930, p. XII+356, pl. 1*).—This is a classified list of the species recorded for the Nyasaland Protectorate up to the year 1930, with brief descriptions and field notes, and a large map which is infolded.

Revision of the tentative list of Chinese birds, N. G. Gee (*Peking Nat. Hist. Bul. 5 (1931), No. 3, pp. 49–68*).—In this revision of a list first published in 1926–27, arranged systematically, the author recognizes 1,032 forms.

Notes on trematodes from a Long Island duck, with description of a new species, H. W. STUNKARD and F. W. DUNIHUE (*Biol. Bul. Mar. Biol. Lab., Woods Hole, 60 (1931), No. 2, pp. 179–186, figs. 4*).—The authors report that an examination of the alimentary tract of a single duck, sold in the New York market, yielded four species of trematodes, representing as many genera. One of the four was found to be new to science and is here described as *Paramonostomum parvum*, and two of the others are recorded from America for the first time, namely, *Psilochasmus oxyurus* (Crep., 1825) Lühe, 1910, and *Notocotylus gibbus* (Mehl. in Crep., 1846) Kossack, 1911.

Leptospira ictero-haemorrhagiae in rats in Trinidad, B. W. I., J. L. PAWAN (*Ann. Trop. Med. and Parasitol., 25 (1931), No. 1, pp. 31–33*).—*L. icterohaemorrhagiae* was found in 32 of 120 rats examined in Trinidad, all but two strains of which were pathogenic to guinea pigs and produced the usual symptoms, followed by death in from 6 to 7 days.

Three species of Coccidia from the woodchuck, Marmota monax, H. B. CROUCH and E. R. BECKER (*Iowa State Col. Jour. Sci., 5 (1931), No. 2, pp. 127–131, figs. 12*).—In addition to *Eimeria monacis* Fish, 1930, the authors add *E. perforoides* n. sp. and *E. os* n. sp. as coccidial parasites of the woodchuck in Iowa.

Recent advances in entomology, A. D. IMMS (*London: J. & A. Churchill, 1931, pp. VIII+374, figs. 84*).—The several chapters of this work deal with some aspects of morphology, metamorphosis, paleontology, the sense organs and reflex behavior, the fundamental aspect of coloration, some aspects of ecology, the practical application of ecology, parasitism, and biological control.

The evolution of the class Insecta, R. J. TILLYARD (*Aust. and New Zeal. Assoc. Adv. Sci. Rpt., 20 (1930), pp. 193–241, figs. 7*).—This extended discussion is accompanied by a list of 34 references to the literature.

The Fabrician types of insects in the Hunterian Collection at Glasgow University: Coleoptera, Part I, R. A. STAIG (*Cambridge: Univ. Press, 1931, pt. 1, pp. XV+110, pls. 28*).—This first part, relating to Coleoptera, deals with types of the families Cicindelidae, Carabidae, Dytiscidae, Scarabaeidae, Silphidae, Histeridae, and Erotylidae.

Report of the Third Imperial Entomological Conference, 17–27th June, 1930 (*London: Imp. Inst. Ent., 1930, pp. 59*).—This report (pp. 6–14) of the third conference, held in June 1930, includes appendixes as follows: Memorandum on the Work of the Imperial Bureau of Entomology from 1st April, 1925, to 31st March, 1930 (pp. 15–26); Estimate of Annual Expenditure Required during the Five Years Beginning 1st April, 1921 (p. 27); and Minutes of Scientific Meetings (pp. 28–59). The report of the second conference has been noted (E. S. R., 54, p. 257).

[Report of the department of entomology], A. I. BOURNE ET AL. (*Massachusetts Sta. Bul. 271 (1931), pp. 254–260*).—A report is first made of work with materials which promise to be of value in insect control. Quad and triplex nozzles proved to be as satisfactory as spray guns and superior to old-type rod and nozzles. They were superior to guns in maintaining a mistlike spray enveloping the trees, and coverage was practically as rapid. Of the miscible oils, Sunoco, Scalecide, and Dendrol showed their customary high efficiency—well over 95 per cent control. Of the emulsions, Kleenup at 4 gal. to 100 gave 95 per cent control, somewhat better than results in 1929. Tests of miscible oils combined with commercial copper fungicides and of soapless emulsions with lime sulfur showed no injury to the trees nor lessened insecticidal efficiency of the oils. Tests made in a block of 15-year-old apple trees selected because of the uniformity of size and spread of the trees indicated a considerable superior-

ity of the oils over lime sulfur in material and time necessary to spray the same number of trees.

Calcium arsenate in combination with aluminum sulfate and lime sulfur used in a block of five varieties of apples showed excellent persistence and caused neither injury to foliage nor russeting of fruit. Calcium arsenate and lime sulfur showed good adhesive qualities but caused considerable burn to foliage of McIntosh and serious burn on other varieties. With the addition of excess lime, burn was not so severe but was present on all varieties including McIntosh. Both sprays caused a considerable drop of leaves during June and July, although to a less degree when excess lime was added. Slight burn was noted following the lead arsenate-lime sulfur combination both with and without casein spreader. The varieties showed considerable difference in susceptibility to burn. Injury was most pronounced on foliage of Baldwin and King, least so on McIntosh. Neither flotation sulfur nor calcium sulfide, used in combination with lead arsenate to test their compatability with that material, caused injury to foliage or russeting of fruit on either McIntosh or Baldwin, both showing good coverage and excellent persistence throughout the season. The comparative value of these sprays based on examination of the McIntosh crop at harvest is shown in tabular form. Flotation sulfur and calcium sulfide combined with lead arsenate controlled scab as well as or better than the lead arsenate-lime sulfur spray, and showed somewhat better control of insect pests. The record on Baldwins showed similar results except that scab was practically absent in all the sprayed plats.

Onion thrips were moderately abundant but caused less injury than in the preceding year, except in some fields of seed onions adjoining sets. Observations, through the growing season, of a field of seed onions at a distance from sets showed the infestation of thrips to be negligible up to July 7, from July 21 to 28 it averaged from 25 to 40 thrips per plant, and reached its peak during the week of July 28 to August 4, with an average of 40 to 42 thrips per plant. A similar field differing in that it was subject to infestation from an adjoining field of sets was found to be infested early in the season, and by July 7 the number of thrips had reached an average of 35 per cent. By July 14 noticeable injury was taking place. The peak of abundance was reached on July 28, with an average of more than 80 thrips per plant. Plants in this field were not making satisfactory growth and were badly scarred by the insects. Two applications of the nicotine-soap spray reduced the average infestation from 80 to 10. These plants revived somewhat and made new growth but matured a small and rather inferior crop. Four applications of nicotine-soap spray were found necessary to protect seed onions growing alongside fields of sets.

In control work with the plum curculio in apples, by W. D. Whitcomb, preliminary studies of the effect of temperature on the activity of the curculio showed that beetles confined at temperatures above 70° F. made three times as many punctures as those held below 70°. "The effect of maximum daily temperatures on curculio activity as determined from insectary records of the past 4 years is variable yet shows an average increase of 12 to 27 punctures per day for each 10° rise in temperature. Beetles feeding on well-sprayed fruit of normal size at the time of the calyx spray lived 10.6 days, and when supplied with normal fruit 1 week later they lived 10.8 days. With sprayed fruit gathered 2 weeks and 3 weeks after the petal-fall period for food, the beetles died in 4.9 days and 3 days, respectively. In both laboratory and field experiments barium fluosilicate and synthetic cryolite failed to control the plum curculio as well as equal amounts of lead arsenate. Chemical hydrated lime added to the lead arsenate-lime sulfur combination

spray was also less effective than the standard solution. Molasses, fish oil, or linseed oil used as a sticker with lead arsenate was more effective than flour paste or calcium caseinate. An 85–15 sulfur-lead arsenate dust was very effective in the laboratory, but barium fluosilicate-lime, cryolite-lime, and napththalene-lime dusts failed to kill the beetles."

In work on the spray residue problem, by Bourne, analyses of fruit from a commercial orchard in which comparative tests were made of different dust materials showed that in a season such as 1930, Wealthy and similar varieties should not be sprayed later than about July 10. Dusts should be applied wherever further protection is necessary. McIntosh sprayed as late as the third week in July showed a sufficient margin of safety, unless heavy drenching applications were made. It was found that Baldwin could be sprayed through July with safety. The results showed that dust, if properly applied to McIntosh and Baldwin, could be used as late as August 15 without encountering any difficulty.

Work on the biology and control of the carrot rust fly at Waltham is briefly reported upon by Whitcomb. The average overwintering number of this pest, in 1930, was 39 pupae per square foot where infested carrots remained in the soil, as compared with 79 per square foot the preceding year. The results of the insecticide treatments in the field were inconclusive because of the light infestation. Carrots grown from seed treated with calomel showed considerable mercury russeting. Derris dust, both pure and diluted 1–2 with gypsum, was very effective in killing the adult flies and prevented oviposition, while 8 other materials were much less effective, in the laboratory. All larvae in infested harvested carrots were killed by fumigation with paradichlorobenzine and carbon disulfide. The carbon disulfide, used at the rate of 4 oz. for each 100 cu. ft. for 18 hours, was the better treatment.

The increased abundance of the apple maggot in recent years led to a study by Bourne of the different control measures adaptable to Massachusetts conditions. The program called for and the work in the 10 orchards where it was carried out in full are reported upon. In the survey conducted infestations of 78 per cent were noted in one instance, and in several orchards the fruit showed from 30 to 40 per cent damage.

Proceedings of the Entomological Society of British Columbia (*Ent. Soc. Brit. Columbia Proc., No. 27 (1930), pp. 51, fig. 1*).—The contributions here presented include the following: Insects Emerging from Prepared Timber in Buildings, by G. J. Spencer (pp. 6–10); Notes on New Methods of Collecting Beetles, by H. B. Leech (pp. 11, 12); Notes on a Digger Wasp, by W. B. Anderson (pp. 13, 14); Notes on *Phalacrocera* Species [*P. vancouverensis* Alex.], an Aquatic Crane Fly (Diptera, Tipulidae), by G. J. Spencer (pp. 15, 16); and The Dermaptera and Orthoptera of Vancouver Island, British Columbia, by E. R. Buckell (pp. 17–51).

Insect pests of sugar cane (*Internatl. Soc. Sugar Cane Technol. Cong. [Surabaya] Proc., 3 (1929), pp. 165–225*).—The contributions relating to insect pests of sugarcane presented at the third congress of the International Society of Sugar Cane Technologists, held at Surabaya, Dutch East Indies, in June, 1929, are as follows: Biological Control of *Oregma lanigera* in Java (pp. 165–168), Determining the Damage Done to Sugar Cane in Java by the White Top-Borer [*Scirpophaga auriflua* Zell. var. *intacta* Sn. (Pyralidae)] and the Striped Stalk-Borer [*Diatraea venosata* (= *striatalis*) (Pyralidae)] (pp. 168–171), Mechanical Control of the White Top-Borer of Sugar Cane in Java (pp. 171, 172), and Insect Pests of Sugar Cane in Java (pp. 172–179), all by E. H. Haselhoff; Sugar Cane Insects of North America and the West Indies (excluding Cuba):

A Bibliography and List of Known Parasites, Insect Predators, and Diseases, by T. E. Holloway (pp. 184–216); and a Summary of Investigations of the Soil Fauna of Sugar Cane Fields in Hawaii, by R. H. van Zwaluwenburg (pp. 216–221).

Tobacco insect studies in 1930, D. S. Lacroix (*Connecticut State Sta. Bul. 326 (1931), pp. 419–431, figs. 9*).—This contribution reports upon a survey made of insects that attack tobacco in Connecticut, a series of insecticide tests, and miscellaneous observations conducted at the Tobacco Substation at Windsor.

The season of 1930 was marked at the very outset by serious injury to newly transplanted tobacco by the seed-corn maggot and by the wireworm *Limonius agonus* Say, the latter pest infesting about 50 per cent of the tobacco acreage in the State. The potato flea beetle appeared throughout the season on Havana Seed and shade-grown tobacco but caused its most serious injury in late July. It was found in practically every field of Havana Seed and shade-grown tobacco visited and on a few Broadleaf plantations, from 25 to 30 per cent of the acreage having suffered material losses from its attack. The injury caused by these pests was followed by that due to grasshoppers, particularly the red-legged grasshopper and the Carolina grasshopper, and mention is made of other pests of less importance.

In combating the southern flea beetle, Paris green and calcium arsenate, cryolite, and barium fluosilicate were applied, the details being reported in tabular form. In experiments at Windsor the repeated applications of Paris green and calcium arsenate that were made on account of many rains in June resulted in extensive burning, that to the foliage being negligible compared with that to the base of the stalk. Where these arsenicals were used diluted with lime (1 part to 5 of lime), the poison injury was slight. Cryolite applied at full strength and also diluted 1 to 5 of hydrated lime kept the flea beetle population down to a fairly low figure, as did barium fluosilicate, and no foliage injury on the plats resulted. Due to the problem of residue on the foliage, dusting was discontinued after July 16 on the Havana Seed. About one week later beetles became very abundant on such plats, causing damage of commercial importance, showing that the pest must be completely suppressed in its first brood or that some insecticide that may be used until harvest and leave no troublesome residue must be found.

Notes, accompanied by charts, are given of the flea beetle population on tobacco at the substation plantation in 1930 and a comparison of such population on shade and sun grown tobacco, together with a table showing the population from June 19 to July 29, 1930, inclusive. A sudden infestation of grasshoppers on some 180 acres of shade-grown tobacco at Avon in July was brought under control by the immediate use of poison bran bait. Notes are also presented on the late infestation of wireworms, injury by the stalk borer, hornworms, and Paris green injury to tobacco resulting from the promiscuous scattering of cutworm bait.

Injurious and beneficial insects affecting the cranberry, H. J. Franklin (*Massachusetts Sta. Bul. 271 (1931), pp. 249, 250*).—Bog tests of pyrethrum soap sprays demonstrated that such sprays are entirely safe to use on cranberry vines whenever it is safe to spray with nicotine sulfate and soap. Applied while the vines are in full bloom or before the berries are well started in growth, they are likely to cause serious loss by blasting the blossoms or newly set berries or by stunting small berries. Pyrethrum extracts without soap, such as Evergreen, did harm to blossoms and small berry sets in some cases, but were generally much less injurious than pyrethrum soap. It is concluded from the season's experiments with pyrethrum soap sprays that such sprays are

eferable to nicotine sprays for treating the first brood of the black-headed eworm, since they are fully as effective and kill much more promptly. Pene-ɔl, used in sprays as directed by the manufacturer, did material injury when plied to cranberry vines during and just after the blossoming period.

Bog tests showed that it takes an application of sodium cyanide solution out 16 hours to kill a satisfactory percentage of an infestation of the cran-rry root grub (*Amphicoma vulpina* Hentz.). In tests conducted with herring tubs of water containing samples of treated bog soil the cyanide poison used combat this grub was found to persist in the soil in considerable strength r at least a week. Six oz. of cyanide to 100 gal. of water applied at the rate 1 gal. to the square foot of soil proved satisfactorily effective in killing all ub stages but killed the pupae much less readily.

Partly grown nymphs of the cranberry black bug (*Plagiognathus repetitus*) d of the false blossom leafhopper (*Ophiola striatula* Fall.) submerged to a pth of about 1 ft. in water survived after 12 hours, but were killed by 18 urs' submergence. This has led to the conclusion that these pests can be ntrolled more safely by flooding in June than has heretofore been thought ssible.

Fig insects in California, P. Simmons, W. D. Reed, and E. A. McGregor '. *S. Dept. Agr. Circ. 157 (1931), pp. 72, figs. 38*).—Following an introduction d a historical discussion, the authors deal with the difficulty of control of ɪects and diseases; their close association; classification of causes of injury; ssification of insect pests of fig fruit; insects attacking ripening and par-lly dried figs; those attacking well-dried, harvested figs; and pests attacking ɛen figs and fig trees. The account is accompanied by a list of 40 references the literature.

Some factors affecting the efficiency of contact insecticides.—I, Surface rces as related to wetting and tracheal penetration, F. Wilcoxon and Hartzell (*Contrib. Boyce Thompson Inst., 3 (1931), No. 1, pp. 1–12, figs. 4*).—e rôle of surface forces in determining the efficiency of contact insecticides discussed. "Preliminary observations have shown that many spray solu-ns wet poorly and do not spread over the insect and form a film unless a table spreading agent is present. It was also found that aqueous spray utions do not penetrate the tracheal system of the larva of the common nato worm (*Phlegethontius quinquemaculata*) without a wetting agent. long the wetting agents used, soaps were found to be the best. Even with use of soap as a spreader the solution did not penetrate the tracheal system a tomato worm larva previously killed with KCN, indicating that respiratory vements or at least vital activity are necessary for penetration to take place. e angle of contact exhibited by soap solutions within the tracheae also indi-es that the capillary forces involved can not account for penetration by this ans alone.

The toxicity to *Aphis rumicis* of nicotine solutions containing no spreader, ɔium caseinate, Penetrol, and sodium oleate has been determined, and com-isons have been made between the toxicity and the spreading coefficients of se four solutions as determined by measurements of surface tension and gle of contact. It was found in these four cases that the toxicity followed same order as the spreading coefficient."

ʟ list is given of 16 references to the literature.

Studies on cranberry false blossom disease and its insect vector, I. D. ɪnosky (*Contrib. Boyce Thompson Inst., 3 (1931), No. 1, pp. 59–83, figs. 11*).—empts at mechanical transmission of cranberry false blossom, a virus disease sidered to be indigenous to Wisconsin and which has become a serious

problem in the culture of the cranberry, proved unsuccessful. A list is given of 44 species of leafhoppers, found in cranberry bogs, collected in an insect survey.

"Insect experiments to transmit the disease with *Phylloscelis atra* Germ., the toad bug; *Gypona octolineata* (Say), the large green leafhopper; and *Platymetopius magdalensis* Prov., the sharp-nosed leafhopper, were unsuccessful. The first successful transmission of false blossom was made in 1926 with the leafhopper *Euscelis striatulus* (Fallen). Successful transmission of the disease in field experiments in 1926 and 1927 were corroborated by laboratory experiments in 1928 and 1929. A description and an account of the life history and habits of the insect vector are given. A cytological study of the carrier, *E. striatulus*, revealed no differences between healthy and viruliferous insects. Bacteria ingested with the food were found in 3 out of 103 insects. *E. striatulus* adults collected on apparently healthy bogs did not transmit the disease. Several hundred check plants kept in the greenhouse remained healthy. Transmission experiments with viruliferous individuals of *E. striatulus* on *Vaccinium corymbosum* L. failed. *E. striatulus* is parasitized by a species of dryinid and a species of pipunculid.

"It is suggested that to control false blossom measures be taken to reduce the numbers of the insect vector on bogs, and that a search be made for resistant varieties of the cranberry."

A list of 28 references to the literature is included.

Oil sprays, E. B. Holland (*Massachusetts Sta. Bul. 271 (1931), p. 270*).—In a brief reference made to work with oil sprays it is stated that as a whole the miscible oils prepared by spontaneous methods are the most promising, easy to make, and relatively inexpensive.

On some limiting factors in the use of saturated petroleum oils as insecticides, H. Knight, J. C. Chamberlin, and C. D. Samuels (*Plant Physiol., 4 (1929), No. 3, pp. 299–321, figs. 2*).—Of the parts of the present investigation, the first, on the physiological effects of saturated, white petroleum oils on citrus, was conducted by Knight and Samuels; the second, on the translocation of petroleum oil in the living plant (citrus), by Knight; and the third, on some factors in the problem of the absorption and translocation of saturated petroleum oil in the living plant, by Chamberlin.

In work previously noted by deOng, Knight, and Chamberlin (E. S. R., 57, p. 258), it was made evident that the use, as insecticides, of saturated petroleum oils (i. e., petroleum oils from which all, or nearly all unsaturated hydrocarbons have been removed, usually 98 per cent or more) produced some adverse physiological effects on citrus trees. A contribution by Knight (E. S. R., 60, p. 649) is relevant.

The accumulation of starch in the leaves is deemed due, not to any real stimulation of the plant, but simply to the fact that as the leaf begins to function again, it manufactures carbohydrates which it can not effectively translocate due to the overloading of the conducting vessels with oil. If this condition persists over a protracted period of time it must eventually react unfavorably on the root system, thus weakening the entire tree. The data suggest an adequate explanation for the many adverse physiological effects observed in the field following the application of heavy, saturated, white petroleum oil sprays. From the effects as summarized, the general conclusion is considered warranted that heavy white oils should be sparingly and very cautiously used to avoid serious injury.

A study on sodium fluo-silicate, with special reference to its toxicity to farm animals, R. Attia (*Egypt Min. Agr., Tech. and Sci. Serv. Bul. 105 (1931), pp. [2]+38, fig. 1*).—The author finds that "the rapidity of death, which is about the same in both goats and rabbits, is quite independent from the dose,

a fact which emphasizes the importance of the factor of individual resistance. The lethal dose is about 0.05 to 0.065 gm. per kilogram of alive rabbits. Doses about 0.07 gm. per rabbit killed 3 rabbits out of 4 in a very short time; the fourth died after 58 days, and it is thought that death is due to general weakness caused by the poison rather than its direct effect. On the other hand, a dose about or a little more than 0.05 gm. per rabbit caused the rapid death of 2 rabbits and has been injurious to another 2, 1 of which died after 44 days. This confirms Dr. Gardiner's opinion [as reported by Reeves (E. S. R., 53, p. 380)], that chronic cases in which poison takes a chronic course end fatally. Rabbits are more susceptible to the effect of the poison than goats [for which the lethal dose is about 0.11 gm. per kilogram]. It is worth while mentioning that the therapeutic dose to man is 1.5 to 6 mg. anhydrous sodium arsenate and 1 to 4 mg. of As_2O_3."

An index of patented mothproofing materials, R. C. Roark (*U. S. Dept. Agr., Bur. Chem. and Soils, 1931, pp. 125*).—This annotated list has been prepared as an aid to those engaged in research on insecticides by making known materials which have been proposed or tested for insect control.

The desert locust, Schistocerca gregaria Forsk., H. H. King (*Wellcome Trop. Research Labs., Ent. Sect. Bul. 30 (1930), pp. 15, pl. 1*).—This is a report of studies of the biology and natural and artificial control of *S. gregaria*.

Notes on the parasites of the cabbage aphid (Brevicoryne brassicae Linn.), H. F. Barnes (*Ent. Mo. Mag., 3. ser., 17 (1931), No. 195, pp. 55–57, fig. 1*).—The emergence of *Aphidius brassicae* Marsh. and *A. polygoni* Marsh., two primary parasites of the cabbage aphid, during the course of a serious outbreak of this aphid in the fall of 1929 is charted.

Morphological and cytological studies on the salivary glands and alimentary tract of Cicadula sexnotata (Fallen), the carrier of aster yellows virus, I. D. Dobroscky (*Contrib. Boyce Thompson Inst., 3 (1931), No. 1, pp. 39–58, figs. 7*).—A comparative morphological and cytological study made of virus-free and virus-bearing individuals of the six-spotted leafhopper did not reveal the presence of any organism that could be associated with the transmission of the virus of aster yellows by this insect. Eighteen references to the literature are listed.

A new species of Erythroneura (Homoptera, Jassoidea) injurious to French beans (Phaseolus vulgaris) in the Sudan, W. E. China (*Bul. Ent. Research, 22 (1931), No. 1, pp. 53, 54, fig. 1*).—Under the name *E. lubiae* the author describes a new species which attacks *P. vulgaris* in the Sudan.

A pentatomid pest of growing beans in South China, W. E. Hoffmann (*Peking Nat. Hist. Bul., 5 (1931), No. 3, pp. 25, 26, pl. 1*).—A pentatomid bug, *Holyomorpha picus* (F.), which attacks the Chinese long bean, the Lima bean, and an unidentified cultivated bean, has caused considerable damage in the region of Canton.

The Crambine genera Diatraea and Xanthopherne (Lep., Pyral.), H. E. Box (*Bul. Ent. Research, 22 (1931), No. 1, pp. 1–50, pls. 5, figs. 5*).—In this revision of the American forms, 48 representing Diatraea of which 10 are new and 4 representing Xanthopherne of which 2 are new are recognized. Keys for their separation; a table showing the distribution, by countries, of the American species of Diatraea; a figure of the geographical range of the two most widely distributed American species of Diatraea, namely, the sugarcane borer and *D. lineolata*; and a discussion of taxonomic method are included.

The Sudan bollworm (Diparopsis castanea Hamp.) in the Sudan, W. E. Giffard (*Wellcome Trop. Research Labs., Ent. Sect. Bul. 27 [1930], pp. 17, pls. 3, fig. 1*).—A summary of information on *D. castanea*, first observed in

Sudan at Khartum in 1906 by King (E. S. R., 21, p. 646), including its life history, habits, and control measures.

Further studies on the seed-corn maggot and bacteria, with special reference to potato blackleg, J. G. Leach (*Phytopathology, 21 (1931), No. 4, pp. 387–406, figs. 14*).—This is in continuation of the work at the Minnesota Experiment Station previously noted (E. S. R., 55, p. 763), in which the author called attention to the rôle of the seed-corn maggot in the spread and development of potato blackleg in Minnesota. In a comparative study made of the internal bacterial flora of the seed-corn maggot, of the principal bacteria associated with the blackleg disease of potatoes, and of certain soil-inhabiting bacteria, several species occurring in each of these groups were found identical. The blackleg pathogene was obtained from each of these three groups, although certain soil saprophytes, including *Pseudomonas fluorcscense* (Flügge) Mig. and *P. non-liquefaciens* Eisenb., appeared to predominate.

"It is concluded that the kinds of bacteria associated with the insect are determined largely by the nature of the material on which it feeds. Flies that have developed in potato plants affected with blackleg would be more likely the carriers of the pathogene than those developing in organic matter destroyed by the common soil saprophytes. Histological studies of the relationship between the seed-corn maggot and bacteria are reported. These studies indicate that bacteria of many species pass uninjured through the intestinal tract of the larvae. The larvae apparently do not feed upon the bacteria as such. Efforts to follow the course of the bacteria in the puparium during metamorphosis were unsuccessful. In the imago, also, bacteria were found to pass through the intestinal tract without injury. Here it appeared that certain species of bacteria were destroyed and digested by the insect, while certain short rod-shape species were uninjured and apparently grew and multiplied in the posterior portion of the tract.

"In neither larva nor imago were the bacteria found to be harbored in special organs but were constantly present in the lumen of the intestines. In the larva bacteria were present in the proventriculus or enlarged portion of the midintestine surrounding the esophageal valve. In the imago the bacteria were present in the crop and intestinal tract. In the crop and a portion of the midintestine the bacteria were scattered throughout the food material, but in the more posterior portions of the intestinal tract they were accumulated in a layer between the food mass and the peritrophic membrane. Their arrangement in definite chains indicated that growth and multiplication had occurred in this location.

"No special devices for insuring contamination of the eggs were observed. The histological relationship between bacteria and this insect are considered to be of a simpler type than most of the Trypetidae studied and described by [H.-J.] Stammer.[1]

"Nutritional studies with the larva of the seed-corn maggot indicate that bacteria aid its development by transforming the plant tissues into a form more readily assimilated. The ability of the larva to grow normally on seed partly decayed by bacteria and then sterilized by heat, as well as on sterile germinating bean seed, indicates that the bacteria are not utilized as food by the insect but that they digest the plant tissues and make them available as food for the larva."

On the nematode parasite of the frit-fly, Oscinella frit L., T. Goodey (*Jour. Helminthol., 8 (1930), No. 3, pp. 123–132*).—Under the name *Tylenchinema*

[1] Ztschr. Wiss. Biol., Abt. A, Ztschr. Morph. u. Ökol. Tiere, 15 (1929), No. 3, pp. 481–523, figs. 25.

oscinella Goodey the author reports upon a nematode parasite taken from the body cavity of *O. frit* on oats, indicating observations of its life history and effect on the host.

A study of the sandfly population in endemic foci of infantile kala-azar in Italy, S. ADLER and O. THEODOR (*Bul. Ent. Research, 22 (1931), No. 1, pp. 105–113, pls. 2, figs. 2*).—In a study made of the sand flies of the two largest Italian foci of visceral leishmaniasis, namely, Naples and Catania, *Phlebotomus papatasii* Scop., *P. perniciosus* Newst., *P. sergenti* Parrot, *P. vesuvianus* n. sp., and *P. parroti* var. *italicus* var. n. were found. Of these *P. papatasii* and *P. perniciosus* were the most common sand flies examined. *P. papatasii* was infected with Italian strains of *Leishmania infantum* by feeding on cultures through membranes. The infection rate was low, but in contrast to Indian strains of *L. donovani* in the same sand fly the infection once established did not die out. None of the 1,547 females dissected showed a natural infection with Leishmania.

Biological control of the greenhouse white-fly, E. R. SPEYER (*Nature [London], 126 (1930), No. 3191, pp. 1009, 1010*).—This is an account of the rearing and dissemination at the Cheshunt Experimental and Research Station in England of the hymenopterous parasite *Encarsia formosa*, an important enemy of the greenhouse white fly, an illustrated account of which (E. S. R., 61, p. 356), together with a detailed account of its life history and that of its parasite (E. S. R., 60, p. 650), have been noted. A table is given which shows that during the years 1927 to 1930, inclusive, 1,500,000 parasitized scales have been distributed to 827 growers of greenhouse plants.

British Mosquito Control Institute (*Brit. Mosquito Control Inst., Hayling Isl., Rpt. Dir., 1930, pp. 16, pls. 15*).—This is a report of the director of the British Mosquito Control Institute.

Final report on a rat-flea survey of the city of San Juan, Porto Rico, A. L. CARRIÓN (*Porto Rico Jour. Pub. Health and Trop. Med., 6 (1931), No. 3, pp. 273–282, figs. 5*).—In the work reported (E. S. R., 62, p. 858) it was found that *Mus norvegicus* is the prevailing rat species in the vicinity of San Juan, and that the oriental rat flea is practically the only flea encountered.

Phytalus (Col., Melol.) in sugar-cane in Mauritius, D. D'EMMEREZ DE CHARMOY (*Bul. Ent. Research, 22 (1931), No. 1, pp. 83–87, fig. 1*).—A discussion is given of the Lamellicorn beetle grubs which attack sugarcane, particularly *P. smithi* Arr. This species was first recorded as a pest in Mauritius in 1911, having apparently been imported from Barbados, and must have been present in Pamplemousses six years previous to its recognition.

Some nemic parasites (Oxyuridae) of coleopterous larvae, J. R. CHRISTIE (*Jour. Agr. Research [U. S.], 42 (1931), No. 8, pp. 463–482, figs. 14*).—Four new oxyurid parasites of scarabaeid larvae are described, of which one from an unidentified scarabaeid larva belonging either to the Rutelinae or the Melolonthinae is placed in the new genus Scarabanema, namely, *S. cylindricum*. Two new oxyurid parasites from the larva of a species of Osmoderma are placed in the genus Thelastoma of Leidy, namely, *T. macramphidum* and *T. papilliferum*, and a new species from the same host is placed in the genus Aorurus of Leidy, namely, *A. subcloatus*. Keys to the genera and species are included.

The temperature relationships of Trichogramma minutum as a basis for racial segregation, S. E. FLANDERS (*Hilgardia [California Sta.], 5 (1931), No. 12, pp. 395–406, figs. 4*).—In this contribution the author deals with the identification of races of *T. minutum*, pigmentation of adult as affected by temperature, and rate of development as affected by temperature. It is pointed out that there are at least four races of this species that can be differentiated by

color when reared at identical temperatures, although at certain dissimilar temperatures they are indistinguishable one from the other.

"A yellow race from Massachusetts is less responsive to variations in temperature, has a shorter life cycle, and develops in a normal manner at a higher temperature than the dark race from tropical Mexico. The relative differences between the life cycle subraces is constant for certain temperatures, but the differences may vary either directly or indirectly with the temperature. The amount of pigmentation in the adult is determined by the duration of exposure to low temperatures during the early pupal period. The slowing up of development by exposure to low temperatures is most marked in the pupal stage. The prepupal and late pupal period are least affected by freezing temperatures. Variations in temperatures between 59° and 77° F. do not produce an acceleration or lagging in the primary reaction of developmental processes to different temperatures."

Reactions of the honeybee to light, L. M. Bertholf (*Jour. Agr. Research [U. S.], 42 (1931), No. 7, pp. 379–419, figs. 13*).—Part 1 of this contribution (pp. 379–391) deals with the extent of the spectrum for the honeybee and the distribution of its stimulative efficiency, part 2 (pp. 391–407) with chroma vision of the honeybee, and part 3 (pp. 407–416) with the ability of the honeybee to distinguish differences of brightness.

It was found that "the upper limit of the spectrum for the honeybee extends to at least wave length 677mμ in the red. The difference between this result and that of 650mμ found by Kühn is probably due to a difference in the intensity of the spectral light used in the two sets of experiments. The lower limit was not ascertained in the research here reported, but according to Kühn it extends to at least 313mμ. The point of maximum stimulative efficiency for the honeybee is in the yellow-green at about 553mμ, which corresponds rather closely with that for man. From this point the efficiency decreases more rapidly for bees than for man toward the longer wave lengths, but more slowly than for man toward the shorter wave lengths, being at 431mμ still fully 10 per cent of the maximum.

"Untrained bees, when allowed to walk toward two sources of light of the same quality, placed near together at the end of a rectangular box, go to the brighter more often than to the fainter, but not in direct proportion to the *relative brightness of the two. The curve representing the relation between* relative brightness and relative magnitude of response is a polynomial one, of such form that the curve showing the relation between the logarithms of the two related variables is an approximately straight line."

A list is given of 37 references to the literature cited.

Bee-keeping new and old described with pen and camera, I, W. Herrod-Hempsall (*London: Brit. Bee Jour., 1930 vol. 1, pp. [5]+772, pls. 2, figs. 708*).—This volume takes up the natural history of the honeybee, the handling of bees, situation and arrangement of the apiary, etc.

Apiary inspection in Pennsylvania, H. B. Kirk (*Penn. Dept. Agr. Bul. 499 (1931), pp. 15, figs. 15*).—This is a practical account of the apiary inspection work as conducted in Pennsylvania, including a draft of the Pennsylvania bee law.

ANIMAL PRODUCTION

Tame versus native pastures, 1930, O. S. Willham (*[Oklahoma] Panhandle Sta., Panhandle Bul. 27 (1931), pp. 3–6*).—Continuing this study (E. S. R., 63, p. 261), the same native and Sudan grass pastures were used, and a sweetclover pasture held over from 1929 was added. It was necessary to

replant the Sudan grass on May 19, and a poor stand was secured to which are attributed the poor results obtained with this grass in this phase of the study.

On May 26 three Holstein heifers were placed on the sweetclover, on June 7 two more heifers were added, on June 26 one heifer was removed, on July 23 two more were removed, and on August 6 the remaining heifers were weighed out. On June 7 three heifers were weighed in on the native pasture, but one was taken out almost immediately. Two heifers were weighed in on Sudan grass on July 15 and weighed out with the heifers on native pasture on August 10. In late September four heifers were weighed in on the native pasture, but lost weight so rapidly that they were removed at the end of one week.

During this phase of the study one acre of native pasture furnished 11.96 days' pasture for a 1,000-lb. animal, the Sudan grass 11.52 days, and the sweetclover 48.33 days. The total pounds of gain per acre were 15.17 lbs. on native grass, —18.3 lbs. on Sudan grass, and 20 lbs. on sweetclover.

The value of alfalfa as a source of vitamin A in sorghum-grain rations, M. C. Smith and M. L. Lynott (*Jour. Agr. Research* [*U. S.*], *42* (*1931*), *No. 7, pp. 421–432, figs. 3*).—Continuing this series of studies (E. S. R., 63, p. 556) at the Arizona Experiment Station, albino rats of the same nutritional history were fed hegari rations containing alfalfa leaf meal ranging in amounts from 1 to 25 per cent. The amount of alfalfa leaf meal necessary to add the vitamin A which is deficient in hegari was measured by the ability of the ration to support optimum growth in young males, to permit females to reproduce and suckle large numbers of vigorous offspring, to permit storage of vitamin A in such quantities as to increase resistance to infection, and to promote long life.

It was found that 5 per cent of alfalfa leaf meal provided enough vitamin A for good growth, and that larger amounts gave no better results. While 5 per cent of alfalfa leaf meal permitted females to produce healthy, thrifty offspring and to rear a large percentage of them, 10 per cent of the meal insured a longer reproductive life. A measure of the relative stores of vitamin A in the bodies of young at weaning time showed an increase in stored vitamin as the percentage of alfalfa leaf meal increased. However, the increment of increase with each increase in percentage of alfalfa leaf meal became decidedly less when more than 10 per cent was incorporated in the ration. While 5 per cent of alfalfa leaf meal increased the length of life, animals fed 10 per cent showed signs of old age at a later date.

Based on these results it is concluded that while 5 per cent of alfalfa leaf meal largely compensated for the vitamin A deficiency of hegari, the use of 10 per cent produced more nearly optimum results.

Effect of a diet of sweet clover on the calcium in the blood serum, C. Y. Cannon and D. Greenwood (*Jour. Dairy Sci., 13* (*1930*), *No. 6, pp. 424–431*).—In this study three lots of rabbits about three months of age were fed for approximately two months. Lot 1 received sweetclover meal and distilled water; lot 2, alfalfa meal and distilled water; and lot 3, alfalfa meal, oats, and fresh cabbage or lettuce daily plus water. Calcium determinations of the blood serum and weighings were made of each animal once a week during the test. The increase in weight was practically the same in all lots.

The serum calcium of the blood of the rabbits in lot 1 decreased, while it remained fairly constant in lots 2 and 3. When the diet of lot 1 was changed to alfalfa meal, the serum calcium content of the blood returned to normal. This decline in serum calcium is probably linked with the failure of the blood to clot in sweetclover "poisoning." The authors suggest that the loss of

serum calcium in the blood may raise the surface tension to such a point that the blood platelets failed to rupture, thus interfering with the formation of thrombin.

Beef production and quality as affected by grade of steer and feeding grain supplement on grass, W. H. BLACK, K. F. WARNER, and C. V. WILSON (*U. S. Dept. Agr., Tech. Bul. 217* (*1931*), *pp. II+44, figs. 24*).—In cooperation with the West Virginia Experiment Station, this study was planned to obtain some definite information on the production costs and comparative quality and palatability of meat resulting from two methods of feeding. Each year of the three 1-year tests 40 steers (with the exception of one year when 39 were used) were selected, consisting of equal numbers of good and medium grades. Each group was wintered separately on a ration of corn silage, wheat straw, and cottonseed meal, and so fed that they entered the grazing season in approximately the same condition. During the grazing season the good and medium steers were each divided into two lots, one of which was fed ground corn and cottonseed meal and the other received grass only. The wintering periods averaged about 140 days, followed by a summer period of 125 days.

The good steers made greater winter gains in proportion to the feed consumed than the medium steers, averaging 78 lbs. per head as compared with 59 lbs. for the medium steers. The good steers fed grain on pasture gained an average of 317 lbs. per head as compared with 337 lbs. of gain for the medium steers similarly fed, while the good steers on grass alone gained 228 lbs. as compared with 249 lbs. for medium steers on grass alone. Feeding corn and cottonseed meal to steers on grass increased the average gains for the 3-year period 37 per cent and increased the selling price of both grades of steers more than 10 per cent, with the medium grade having a slight advantage. The medium steers fed grain on grass and those on grass alone returned a somewhat greater margin per 100 lbs. than the corresponding good steers. The results indicate that feeding a grain supplement to 3-year-old steers on good pasture increased the gains sufficiently to more than offset the additional cost. The relative returns from the grade of steers fed depended upon the margin obtained, since the combined winter and summer gains for both grades were practically equal.

The results of the cattle grading showed that the good steers fed grain on grass graded good as feeder and as slaughter cattle, while the same grade on grass alone graded in the middle of good as feeders and at the bottom of good as slaughter cattle. The medium cattle fed grain on pasture graded in the middle of medium as feeders and at the top of medium as slaughter cattle, while those on grass alone graded in the middle of medium both as feeder and as slaughter cattle. Both lots fed grain on grass had a higher dressing percentage and fatter, more attractive carcasses than those fed grass alone, with the good steers having a slight advantage over the medium steers.

The meat studies showed that the color of the eye muscle of the grain-fed cattle was a somewhat lighter red than that of those fed grass alone. The rib samples of the grass-fed steers contained a higher percentage of bone and eye muscle and a lower percentage of fat than the grain-fed steers, while the chemical and physical analyses showed a higher percentage of fat and a lower percentage of protein and water in the samples from the steers fed grass alone. The chemical analyses of the eye muscle showed a slightly higher fat content for the grain-fed steers, although there was a wide individual variation.

Cooking tests showed that losses from evaporation varied through a narrow range with the fattest ribs showing the smallest losses, while the losses from drippings were greater from the fatter samples than from the thinner ones,

although there was great variation in this respect. The total cooking losses showed a tendency for the fatter samples to lose more than the thinner ones.

There was little difference in the shearing strength of the raw rib muscles among the four lots and no consistent relation between the shearing strength of the raw and cooked meat. There was no significant correlation between the flavor, juiciness, texture, and aroma of the rib samples of the four lots.

Grinding shelled corn, barley, and alfalfa hay; feeding cane molasses to fattening cattle; peat-land hay as roughage for cattle, W. H. Peters (*Minnesota Sta. Bul. 274 (1931), pp. 27*).—The results published in this bulletin are divided into three parts.

The study in part 1 was conducted to determine the value of ground feed and consisted of three tests in which yearling steers were fed for periods of 180, 175, and 175 days each. When fattening cattle were fed a ration of shelled corn and alfalfa hay, both of fair quality, with hogs following the cattle, there was no particular advantage to be gained by grinding either the corn or the alfalfa or both and mixing before feeding. Since a large percentage of whole barley passed through the digestive tract of steers untouched and the hogs following the steers did not successfully salvage the grain, it was concluded that barley should be ground medium fine for feeding to fattening cattle. Feeding ground barley during the first half of the feeding period and finishing on shelled corn proved to be a satisfactory method of fattening cattle.

In the second part two tests were conducted to determine the importance and value of cane molasses for fattening cattle. Yearling steers were fed for 161 days in the first test and steer calves for 189 days in the second test. These tests showed that cane molasses either in small or large amounts had a stimulating effect on the appetite of fattening cattle. However, with a suitable ration the feeding of cane molasses either in large or small amounts had little effect upon the rate of gain and tended to lower the margin of profit over feed cost. Grinding and mixing all the feeds, including molasses, did not increase the rate of gain materially and decreased the profit returned when the grain portion of the ration was composed of corn and hogs followed the cattle.

In a test with yearling steers peat land hay grown on well fertilized fields was slightly more palatable than upland timothy hay and produced larger and more economical gains. Adding bone meal to peat land hay produced no beneficial effect. As a roughage for fattening yearling steers it was found that timothy or timothy and alsike clover mixed hay grown on properly fertilized peat soil showed a normal composition, was palatable, and had a feeding value equal to timothy hay grown on normal upland soil.

Crossbreeding experiment in the production of California spring lambs, R. F. Miller (*Natl. Wool Grower, 20 (1930), No. 6, pp. 23–25, figs. 5*).—Continuing this study (E. S. R., 62, p. 459) at the California Experiment Station through the third year, 6 lots of 20 Rambouillet ewes each and 4 lots of 20 Romney-Rambouillet ewes each were mated with the same rams of Southdown, Shropshire, Hampshire, Suffolk, Romney, and Rambouillet breeding. The ewes bred to the Romney rams were omitted in this phase of the study, due to the failure of the rams to get the ewes with lamb during the early part of the breeding season. None of the crossbred ewes were bred to Rambouillet rams.

Of the lambs from the Rambouillet ewes, the Hampshire cross led in weight of all lambs, followed in descending order by the Suffolk, Shropshire, Southdown, and Rambouillet lambs. There was a fairly even distribution of twin lambs, with the highest percentage born in the Rambouillet and the lowest in the Southdown crosses. In pounds of lamb raised per ewe, the Suffolk crosses led, followed by Hampshire, Rambouillet, Shropshire, and Southdown, respec-

tively. The grading of lambs on the hoof showed that the Southdowns led with about 50 per cent choice and 50 per cent good lambs, followed by Hampshires with 31 per cent choice and 58 per cent good lambs. These lots were followed by Shropshire, Suffolk, and Rambouillet. In value per lamb the Hampshire crosses led, with the Southdown, Shropshire, Suffolk, and Rambouillet ranking next in order. The Southdown and Hampshire lots had the largest number of choice carcasses, with Suffolks third, and Shropshires and Rambouillets last. The dressing yield varied from 48.4 per cent for Rambouillets to 53.2 per cent for Southdowns.

Of the lambs from the crossbred ewes, the Suffolks ranked first in weight of lambs, pounds of lamb produced per ewe, and in total value per lot. The Hampshire lambs ranked second to the Suffolks in the above respect, while there was little difference between the Shropshires and Southdowns. In grade of lamb on foot the Southdowns led, followed by Hampshires, Shropshires, and Suffolks. The dressing percentages were 52.5, 51, 50.9, and 46.5 for the Southdown, Suffolk, Hampshire, and Shropshire crosses, respectively.

A comparison of the two types of ewes showed little difference in the final weights of all the lambs produced or in the average daily gains of these lambs, but the Rambouillet ewes sheared about 2 lbs. more wool than the crossbred ewes. The Rambouillet ewes bred more readily in July, but the lambs from the crossbred ewes had a somewhat better mutton conformation, particularly the Suffolk and Hampshire crosses.

Annual wool review for 1929, J. B. McPherson (*Bul. Natl. Assoc. Wool Manfrs., 60 (1930), Extra No. 1, pp. 101–216*).—The status of the production, commercial movement, and manufacture of wool in the United States and elsewhere is reviewed for 1929, with the usual statistical information.

The effect of calcium fluoride and phosphate rock on the calcium retention of young growing pigs, F. J. McClure and H. H. Mitchell (*Jour. Agr. Research [U. S.], 42 (1931), No. 6, pp. 363–373, fig. 1*).—Continuing the study of mineral supplements for pigs (E. S. R., 64, p. 864) at the Illinois Experiment Station, 5 pigs averaging approximately 155 lbs. initial weight were confined in metabolism crates for the duration of the 14 periods of 2 weeks each. They were fed a basal ration of ground corn, soybean oil meal, linseed meal, cod-liver oil, and salt 79.5:15:4:1:0.5. To the basal ration of each pig there were added daily 5 gm. of calcium in the following forms: Pure tricalcium phosphate, tricalcium phosphate and calcium fluoride combined in different proportions for different pigs, and tricalcium phosphate and rock phosphate in different proportions. Each pig received different concentrations of fluorine approximating 0.5, 1, 2, 3, and 3.8 per cent, respectively, of the mineral mixture, but in all cases 5 gm. of calcium daily. During the periods when no fluorine was added to the ration, each pig received 5 gm. of pure tricalcium phosphate daily.

The results showed that mineral supplements containing 2 per cent or more of fluorine apparently exerted a detrimental effect on food consumption and growth, and at 3 per cent or higher levels had a distinct toxic effect. There were also indications that rock phosphate exerted a more detrimental effect than the synthetic mixture of tricalcium phosphate and calcium fluoride containing a like amount of fluorine. These results did not demonstrate conclusively that feeding fluorides even at the higher levels had any effect on calcium utilization, although there were indications that the high levels had a depressing effect on calcium metabolism.

Based on the results of this study it was concluded that it was not advisable to supply the entire calcium requirements of pigs with rock phosphate, but that one-third or less of the requirements may be fed in the form of rock

phosphate without producing bad effects over a short period. It was recommended, however, that before using rock phosphate it should be shown that not only was it not toxic but that it was as efficient a calcium supplement as bone meal, limestone, and other supplements of known value.

Effect of soybeans and soybean oil meal on quality of pork, S. Bull, W. E. Carroll, F. C. Olson, G. E. Hunt, and J. H. Longwell (*Illinois Sta. Bul. 366 (1931), pp. 33–80, figs. 5*).—Concluding this series of studies (E. S. R., 64, p. 864), it was found that pigs fed to 225 lbs. of live weight on corn or barley with enough soybeans to balance the ration produced soft pork. Feeding hogs a balanced ration of corn and soybeans to 150 lbs. in weight and finishing on corn and tankage or feeding corn and tankage to 115 lbs. in weight and finishing on corn and soybeans produced soft pork. The cause of the soft carcasses was attributed to the high content of low-melting oil in the soybeans. The dressing percentage of hogs fed corn and soybeans was lower than that of hogs fed corn and tankage.

Hogs fed corn and soybean oil meal produced acceptable carcasses, and this protein supplement was apparently suitable for growing fattening pigs. Soybeans were fed to brood sows without ill effects, but no method was found for using them in the ration of fattening pigs without lowering the quality of the pork. On the basis of rate and economy of gains, soybeans were not as efficient as tankage as a supplement to corn or barley.

Changes in hens' blood produced by a diet of sprouted soybeans, A. A. Horvath (*Amer. Jour. Physiol., 94 (1930), No. 1, pp. 65–68*).—In this study the blood of hens fed a sole diet of sprouted soybeans for 40 days clotted in a few minutes, even in the presence of 0.2 gm. per cent of potassium oxalate. There was a definite rise in the uric acid content of the blood serum of these hens. No symptoms of gout developed in these hens, due possibly to the high fat-soluble vitamin content of the soybeans. Feeding sprouted soybeans caused a rise in the globulin-albumin ratio of the blood serum of the hens.

The distribution of blood calcium in the circulation of laying hens, G. D. Buckner, J. H. Martin, and F. E. Hull (*Amer. Jour. Physiol., 93 (1930), No. 1, pp. 86–89*).—A study at the Kentucky Experiment Station was made to determine the distribution of blood calcium in the circulation of laying and nonlaying hens in an effort to discover to what extent calcium was taken directly into the blood stream from the food in the intestines.

The results showed that in nonlaying hens the arterial blood going to and the venous blood coming from the intestines contained the same amount of calcium. The calcium content of the blood of the laying hen was higher than that of the nonlaying hen. Blood from the anterior mesenteric vein of the laying hen had an appreciably higher calcium content than that of blood from the anterior mesenteric artery, while the blood from the left ventricle was intermediate between these values.

The blood calcium of laying hens varied by the calcium intake, G. D. Buckner, J. H. Martin, and W. M. Insko, Jr. (*Amer. Jour. Physiol., 94 (1930), No. 3, pp. 692–695*).—At the Kentucky Experiment Station, White Leghorn hens were divided into 2 lots of 9 head each, and a calcium carbonate supplement was withheld from the ration fed to lot 2. A record was kept of the number and weight of eggs laid by each hen, and the shells of the eggs were removed, washed free from albumin, dried at 100° C. for 12 hours, and weighed when cool. At the end of 14 and 28 days from the time of withholding the calcium carbonate, blood samples were obtained from each hen and the calcium content of the serum was determined.

The hens in lot 1 were vigorous and active and had good appetites throughout the test, while those in lot 2 were nervous and inactive and at the end of the study one hen was unable to stand. During the 6 weeks of the test the average blood calcium content of the hens in lot 1 did not diminish, while that of the hens in lot 2 decreased about 27 per cent. In lot 1 the average weight of the contents of the eggs increased nearly 8 per cent, the average weight of dry shell more than 12 per cent, and the average egg production 30 per cent. In lot 2 there was a decrease of 11, 21, and 78 per cent in the above respects.

Breeding poultry for egg production (*Massachusetts Sta. Bul. 271 (1931), pp. 278, 279*).—Continuing this study by F. A. Hays and R. Sanborn (E. S. R., 63, p. 563), it was found that the mean annual egg production of 352 birds hatched in 1928 was 221.4 eggs. The mortality rate of this flock for the full laying year was 14.85 per cent. The hatching records for the flock for the spring of 1929 showed that 77.7 per cent of the fertile eggs hatched and for the spring of 1930 74.5 per cent of the fertile eggs hatched. The intensity, persistency, and mean egg size of this flock were increased, the mortality rate decreased, and the winter pause shortened as compared with previous flocks.

Care and management of baby chicks, W. C. THOMPSON (*New Jersey Stas. Circ. 247 (1931), pp. 32, figs. 29*).—This is a revised edition of Circular 199, previously noted (E. S. R., 56, p. 870).

The management of baby chicks in confinement, C. M. BICE (*Hawaii Sta. Circ. 1 (1931), pp. 15, figs. 9*).—A successful method of handling and feeding chicks in confinement under Hawaiian conditions is discussed in this publication.

A technical study of the growth of White Leghorn chickens, H. H. MITCHELL, L. E. CARD, and T. S. HAMILTON (*Illinois Sta. Bul. 367 (1931), pp. 81–139, figs. 8*).—Continuing this series of studies (E. S. R., 55, p. 669), a similar investigation was made with a flock of approximately 1,000 Single Comb White Leghorn chickens. A sample of 10 newly hatched chicks was taken at the start of the experiment for measurement and analyses, and when the average weight of the pullet and cockerel flocks reached approximately 0.5, 1, 1.5, 2, 3, and 4 lbs., samples of 10 cockerels and 10 pullets weighing very close to the average were removed. A final sample of 10 cockerels was taken when the remaining birds of this flock averaged 5 lbs.

The birds increased in size in such a manner that their conformation, exclusive of feathering, did not materially change. The dimensional differences between cockerels and pullets were not marked, except that when the body weight was greater than 2 lbs. the leg measurements of the cockerels were larger than those of the pullets. The pullets were consistently larger in breadth at hips, and they averaged larger in midcircumference than the cockerels except at the 4-lb. weight. The skin area of each bird was determined after the skin was removed from the body, and the areas obtained related to the body weight by means of the equation $S=8.19W^{[illegible]}$, in which S is the surface area in square centimeters and W the body weight in grams. The relative weights of the different parts of the carcasses and the empty weights of the birds killed at different ages are given in the following table:

Average weights of parts of carcasses of White Leghorn cockerels and pullets killed at different weights, expressed in percentage of empty body weight

Kind of bird	Approximate slaughter weight	Age	Average empty weight	"Fill"	Feathers	Blood	Head	Shanks and feet	Heart	Liver	Kidneys	Pancreas
	Lbs.	*Days*	*Grams*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Cockerel	(1)	2	27.5	11.4	------	3.89	15.1	4.91	0.84	3.85	0.82	0.31
Pullet	(1)	2	27.5	11.4	------	3.89	15.1	4.91	.84	3.85	.82	.31
Cockerel	0.5	44	209	4.3	5.55	3.83	6.22	5.02	.84	3.36	1.43	.46
Pullet	.5	44	212	4.9	6.46	3.94	5.52	4.63	.66	2.98	1.34	.48
Cockerel	1	58	460	3.5	7.74	4.22	4.59	5.00	.58	2.74	1.16	.42
Pullet	1	58	453	3.2	8.72	4.17	4.11	4.75	.50	2.47	1.04	.40
Cockerel	1.5	72	658	3.0	8.50	4.19	4.36	4.86	.51	2.40	.93	.32
Pullet	1.5	72	649	3.0	8.67	3.91	3.56	4.61	.43	2.30	.94	.30
Cockerel	*2*	*86*	*854*	*2.4*	*7.69*	*3.84*	*4.58*	*4.91*	*.48*	*2.34*	*.90*	*.28*
Pullet	2	100	866	2.7	9.05	3.68	3.20	4.08	.39	2.04	.83	.29
Cockerel	*3*	*107*	*1,285*	*2.5*	*6.89*	*4.19*	*4.82*	*4.95*	*.48*	*1.91*	*.68*	*.25*
Pullet	3	159	1,333	2.5	7.65	3.82	2.85	3.21	.38	1.83	.72	.24
Cockerel	4	156	1,677	2.4	7.99	4.71	4.14	4.28	.47	2.03	.67	.23
Pullet	4	233	1,677	2.3	5.80	3.51	2.67	2.71	.40	1.89	.68	.19
Cockerel	5	219	2,074	2.9	8.63	5.26	4.09	4.08	.55	2.15	.66	.22

Kind of bird	Spleen	Lungs	Testicles and ovaries [2]	Digestive tract	Skin	Neck	Legs above hock	Wings	Torso	Total bone in dressed carcass	Total flesh and fat in dressed carcass	Total flesh, fat, edible viscera,[3] and skin
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Cockerel	0.06	0.97	------	15.3	11.8	3.78	12.6	2.80	12.9	42.9	------	53.6
Pullet	.05	.97	------	15.3	11.8	3.78	12.6	2.62	12.9	42.9	------	------
Cockerel	.15	.68	0.04	13.2	7.08	3.59	15.6	6.65	20.5	16.5	26.8	41.9
Pullet	.17	.69	------	12.9	6.79	3.50	15.0	6.70	22.5	15.5	29.5	44.1
Cockerel	.15	.57	.04	11.7	6.52	3.61	17.3	6.93	23.3	16.3	32.6	45.5
Pullet	.19	.53	------	11.2	6.27	3.40	17.8	7.31	24.1	15.2	35.3	47.8
Cockerel	.17	.55	.06	10.6	6.47	3.24	18.8	6.98	24.0	14.6	36.0	48.4
Pullet	.18	.51	------	10.3	6.15	3.20	18.5	7.33	25.4	15.7	36.8	48.8
Cockerel	.19	.49	.40	9.3	6.43	3.21	19.7	7.03	25.1	15.3	38.3	49.9
Pullet	.18	.54	------	10.1	6.48	3.13	18.8	7.26	27.3	14.3	40.9	52.6
Cockerel	.18	.53	.56	8.32	6.82	3.34	21.2	7.29	25.4	15.6	40.2	51.7
Pullet	.20	.44	.28	10.1	7.39	2.66	18.8	6.38	30.8	12.5	44.5	56.7
Cockerel	.16	.55	.33	8.32	7.16	3.10	20.9	6.74	26.6	14.7	41.4	53.5
Pullet	.13	.39	2.52	9.72	7.69	2.34	18.1	5.72	32.7	11.7	45.6	57.9
Cockerel	.17	.50	.23	7.2	6.65	2.85	21.6	6.41	26.7	14.3	41.6	53.0

[1] Hatching weight. [2] Includes weight of oviduct. [3] Including heart, liver, and gizzard.

Most of the organs and parts of the carcass increased in weight progressively as the body weight increased, but this was not true with the percentage weights with reference to empty body weight. There was more variation in the weights of all organs and separated parts for the pullets than for the cockerels, except for gizzard weights and weights of bones in dressed carcasses. The spleen showed the greatest variability of all the organs.

Chemical analyses showed higher fat percentages for the pullets in all cases except the feathers and at all weights above 1.5 lbs. The pullets fattened more rapidly and continuously than the cockerels, which after a weight of 2 lbs. *showed no further tendency to fatten.* At 4 lbs. weight the pullets contained an average of 19.55 per cent of fat as compared with 5.92 per cent for the cockerels. At from 3 to 5 lbs. the edible meat contained from 45 to 57 per cent of the total dry matter of the entire carcass, 51 to 70 per cent of the total fat, about 50 per cent of the total protein, 14 to 18 per cent of the total ash, and slightly over 1

per cent of the total calcium. The feathers contained 20 per cent or more of the crude protein of the carcass. From 62 to 68 per cent of the ash and from 81 to 89 per cent of the calcium in both sexes were contained in the bones of the dressed carcass. The pullets produced more edible dry matter, fat, and energy than cockerels at weights of 2 lbs. or more, and only at 4 lbs. did the cockerels produce more edible protein.

It was computed that at a weight of 2 lbs. and at an age of 12.5 weeks cockerels were gaining in body weight at the rate of 11.8 gm. daily and were daily depositing in their bodies 3.91 gm. of dry matter, 2.63 gm. of protein, 0.9 gm. of fat, 0.437 gm. of ash, 0.165 gm. of calcium, and 21.5 calories of gross energy. Pullets at the same weight, but at an average age of 14.8 weeks, were gaining 9.6 gm. daily in weight and were depositing 3.78 gm. of dry matter, 2.06 gm. of protein, 1.15 gm. of fat, 0.328 gm. of ash, 0.108 gm. of calcium, and 24.8 calories of gross energy in their bodies daily.

DAIRY FARMING—DAIRYING

[Experiments with dairy cattle at the Massachusetts Station] (*Massachusetts Sta. Bul. 271 (1931), pp. 271–273*).—The results of three studies by J. B. Lindsey and J. G. Archibald are briefly noted.

Milk substitutes in the growing of young calves.—A group of 9 Holstein calves was fed whole milk for 3 weeks, and the amount decreased the fourth week until at the beginning of the fifth week they received only dry feed (E. S. R., 62, p. 257). At this time they were fed alfalfa for roughage and a grain mixture containing 12.5 per cent of soluble blood flour. At 4 months of age the calves averaged 231 lbs. per head, having made an average daily gain of 1.15 lbs. A second group of 5 calves, fed in the same manner except that rowen replaced the alfalfa, averaged 228 lbs. per head at 4 months and made an average daily gain of 1.12 lbs. A third group, handled in a similar manner except that white fish meal replaced the blood flour, made an average daily gain of 1.02 lbs. and weighed 227 lbs. at 4 months. The calves grown on dry feed appeared thin, pot-bellied, and were not in as satisfactory condition as calves receiving some form of milk.

Mineral requirements for the growth of dairy heifers.—Continuing this study (E. S. R., 62, p. 663), 2 groups of Holstein heifers were fed either a high- or low-calcium ration from approximately 140 to 858 days of age. The high-calcium ration consisted largely of alfalfa hay with dried beet pulp and a grain mixture made up largely of corn meal, while the low-calcium ration group received hay of mixed grasses, dried apple pomace, and corn and linseed meals. In all, 76 metabolism trials were made with these animals. There was a considerable storage of all elements by the high-calcium group the first year with a lowering of retention later. The low-calcium group made its greatest effort to accumulate a mineral reserve during the third year. Regardless of the ratio of calcium and phosphorus intake, the retention ratio of 2 : 1 was quite uniform in both groups and at all ages. There was little difference in the weight or height at withers of the 2 lots. On the basis of the results obtained, it was concluded that in order to secure satisfactory growth a heifer should receive 4.5 gm. of calcium daily from her ration during the first year, 3 gm. daily the second year, and 2.5 gm. daily the third year per 100 lbs. of live weight.

Two systems of dairy cattle feeding—high roughage and low grain v. low roughage and high grain.—One year's results showed little difference in the economy of milk production of a group of cows fed on a maximum roughage

and a low grain ration and one fed a minimum roughage and a high grain ration.

Size of cow and efficiency of milk production, W. L. GAINES (*Jour. Dairy Sci., 14 (1931), No. 1, pp. 14–25, figs. 2*).—The figures published by McDowell (E. S. R., 63, p. 269) were reworked at the Illinois Experiment Station to show by live weight of cow and breeds the energy yield in pounds of 4 per cent milk, the theoretical coefficient of efficiency, and the recorded feed cost in dollars per 100 lbs. of 4 per cent milk.

The energy yield was practically the same for both grade and registered cows of the Guernsey and Ayrshire breeds, but was materially greater for the registered Jersey and Holstein cows. The grade cows of all four breeds had a lower feed cost per 100 lbs. of milk, the difference averaging approximately 10 cts.

For all the breeds the energy yield increased with size of cow in a linear manner at the rate of 250 lbs. of 4 per cent milk per year for each 100 lbs. increase in weight. The theoretical coefficient of efficiency decreased with increasing weight, and when interpreted in feed cost per unit of milk with size of cow amounted to approximately 3 cts. per 100 lbs. of 4 per cent milk for each 100 lbs. increase in live weight. The feed cost per 100 lbs. of 4 per cent milk decreased with the live weight of cow in the range of 600 to 800 lbs. and was practically constant in the range of 800 to 1,600 lbs. It was thought that the discrepancy between the theoretical efficiency and the recorded feed cost was due to systematic errors in bookkeeping.

Appended is a discussion of results obtained from certain herd books of the Dairy Herd Improvement Association of Illinois. From these data were calculated the average feed cost per 100 lbs. of 4 per cent milk for the months April and June. The regression of feed cost on weight was represented by straight lines, and the greater slope of the June curve was attributed to the use of pasture and the charge made for it in that month.

A new view of the effect of temperature on milk production in dairy cows, K. W. D. CAMPBELL (*Jour. Agr. Sci. [England], 21 (1931), No. 1, pp. 167–177, figs. 7*).—In this study at the University of Reading, England, an attempt was made to show the relationship between temperature and milk production. While the results are not conclusive, the author is of the opinion that temperature variation during a 24-hour period was a contributing factor to the low fat content of morning milk under twice daily milking conditions with uneven intervals. Other factors, such as change in quantity and kind of feed, change of pasture, exercise, lack of drinking water, and unusual rainfall were considered, but there was no evidence that they influenced the results to any appreciable extent.

Care and management of the dairy bull, J. P. LAMASTER (*South Carolina Sta. Bul. 272 (1931), pp. 12, figs. 7*).—The housing and equipment that should be furnished for a dairy bull, together with suggestions on the feeding and management of the bull, are described in this publication.

[Experiments in dairying at the Massachusetts Station] (*Massachusetts Sta. Bul. 271 (1931), pp. 252–254*).—The results of three studies are noted.

Factors affecting the aging time of ice cream mix.—The results obtained by K. E. Wright in this study indicate that the solidification of the fat is a minor factor affecting the aging time of a mix, while adsorption is probably the important factor. Only 50 per cent of the benefits of a 24-hour aging period are obtained during the first 4 hours, and the rate of adsorption seems to depend upon the amount of emulsifying agent available. A mix made with butter improved in whipping qualities more slowly than a cream mix or a mix containing

egg yolk. The relationship between surface tension and ease of whipping was significant. Mixes aged for 24 hours showed a decrease in surface tension, and cream mixes had a lower surface tension than butter mixes. The surface tension of buttermilk was lower than that of skim milk, and the addition of the former to a butter mix lowered the surface tension and improved the whipping qualities.

Use of gelatin in ice cream.—In studying new uses for gelatin in ice cream, W. S. Mueller developed gelatin fruit cubes, modified Aufait ice cream, and filling for ice cream pies and cubes. The same principle was applied in all of these uses, which consisted of adding edible gelatin to fruit juices or to a water solution containing fruit acid, while crushed fruit could also be added.

An initial cooling temperature of 20° C. (68° F.) for 4 hours with ice cream mixes containing gelatin gave a maximum basic viscosity, increased the gel strength and melting resistance, and improved the texture of the mix used.

Preliminary studies have indicated that gelatin has a greater value for retarding sandiness in ice cream than was generally conceded.

Initial experiments with commercial stabilizers for use with gelatin in ice cream have shown a mutual precipitation of gelatin with some stabilizers and none with others.

The comparative efficiency of electrically-operated tanks v. ice in the cooling of milk.—J. H. Frandsen found that a cooling tank for milk should have enough capacity so that when filled with cans there would be ample room for twice as much water and ice as milk. An insulating layer of 3 or 4 in. of cork saved more than its cost in refrigeration in one season. Electric cooling of milk was practical, labor-saving, and more sanitary than natural ice.

Fat-soluble vitamins.—XXX, The antirachitic value of cow's milk as modified by the feeding of irradiated yeast, H. Steenbock, E. B. Hart, F. Hanning, and G. C. Humphrey (*Jour. Biol. Chem., 88 (1930), No. 1, pp. 197–214*).—Continuing this series of studies at the Wisconsin Experiment Station (E. S. R., 64, p. 769), it was found that feeding 50 gm. of irradiated yeast to cows increased the antirachitic potency of the milk. As much as 200 gm. of yeast was fed without any detrimental effect on milk production or butterfat content, and when the amount of yeast was reduced to 10 gm. daily there was still a noticeable effect on the antirachitic potency of the butterfat, although the effect on the milk was not clearly demonstrable. Feeding 180 gm. of cod-liver oil produced the same effect as 10 gm. of yeast.

The authors suggest the possibility of feeding a standardized irradiated yeast for the production of a milk of a standard antirachitic potency.

The influence of feeding clover silage on the quality of sweet butter [trans. title], M. M. Kazanskiĭ (Kasansky) and A. A. Lomunov (Lomunoff) (*Trudy Vologodsk. Moloch. Khoz. Inst.* (*Arb. Milchw. Inst. Wologda*) *Bul. 81 (1929), pp. 105–118*).—Cream from cows fed clover silage and from cows receiving no silage was divided into two lots, one of which was pasteurized. All lots were churned into butter. An analysis of the butter showed that feeding silage had no effect on the taste but did improve the consistency of the butter. The physicochemical properties of the butterfat showed no significant differences between the two lots. Butter made from pasteurized cream scored somewhat higher than that made from raw cream.

The influence of feeding cows clover silage on the quality of Holland cheese [trans. title], A. N. Korolev (Koroleff), A. I. Vlasov (Wlassoff), and S. A. Babkina (*Trudy Vologodsk. Moloch. Khoz. Inst.* (*Arb. Milchw. Inst. Wologda*) *Bul. 81 (1929), pp. 119–137, figs. 2*).—In this study 15 batches of Holland cheese were made from the milk of cows fed clover silage and a similar

number from the milk of cows receiving no silage. The raw milk in both cases was tested for its ripening properties, acidity, and fat content. The cheese was made in the regular way and stored for 105 days before scoring.

Milk from the cows receiving no silage was slightly more acid and required less time to ripen than the milk from cows fed silage. There was no significant difference in the quality of the cheese made from the two milks.

How the cream layer forms on milk, A. C. Dahlberg and J. C. Marquardt (*New York State Sta. Bul. 591 (1931), pp. 11, figs. 2*).—This is a popular presentation of that portion of Technical Bulletin 157 (E. S. R., 62, p. 769) which refers to the way in which the cream layer is formed and the cause of the formation of fat clusters.

The creaming of raw milk, A. C. Dahlberg and J. C. Marquardt (*New York State Sta. Bul. 593 (1931), pp. 11, figs. 2*).—This is a popular presentation of that portion of Technical Bulletin 157 (E. S. R., 62, p. 769) which deals with the variations in the cream layer of milk from different breeds of cows and to the methods by which the deepest cream layer was secured.

***A modification of the methylene blue reduction test and its comparative* value in estimating keeping quality of milk,** C. K. Johns (*Sci. Agr., 11 (1930), No. 4, pp. 171–190, figs. 6*).—In a study at the Central Experimental Farm, Canada, 145 samples of milk were examined by the ordinary methylene blue reduction test, by a modification of this test, by acidity increase, and by plate and Breed counts in an effort to rank milks in approximate order of keeping quality. The modified reduction test proved to be best suited for this purpose.

The modifications introduced in this new method consisted of (a) preliminary incubation at 55° F. (12.8° C.) for 18 hours and (b) mixing the contents of tubes not decolorized in 6 hours when subsequently incubated at blood heat. Both modifications shortened the reduction time, and the mixing also reduced variations between duplicate tubes. The modified test was of greater convenience to the analyst, improved the accuracy on high-grade milks, and permitted closer correlation with keeping quality than the other tests.

Effect of carbonation on bacterial content and keeping quality of dairy products, M. J. Prucha, J. M. Brannon, and H. A. Ruehe (*Illinois Sta. Bul. 368 (1931), pp. 141–163, figs. 4*).—Since carbon dioxide has been used extensively in the preparation of certain beverages, an effort was made to determine the effect of carbonation on dairy products. Milk, cream, condensed milk, and ice cream mix were treated with carbon dioxide gas until completely saturated and then held in more or less air-tight containers.

Carbonation tended to inhibit the growth of some species of bacteria, while others multiplied as rapidly as in the uncarbonated product. This inhibiting effect tended to prolong the keeping period of the product. The temperature at which the product was kept after carbonation, the pressure of the carbon dioxide gas, and the amount and kind of bacterial contamination prior to carbonation influenced the keeping period. Holding carbonated products at from 32 to 50° F. improved their keeping quality as compared with uncarbonated products, but when held at 70° they spoiled in approximately the same time. Carbonated raw milk held at 70° at a pressure of 60 lbs. did not spoil until the ninth day, while uncarbonated raw milk spoiled in two days. Holding one sample of freshly pasteurized milk at about 40° at 180 lbs. pressure completely inhibited bacterial multiplication. Carbonation of a product which had a high bacterial count did not appreciably affect its keeping qualities.

Carbonation did not produce any significant reduction in the number of bacteria in ice cream, and the results of treating sweet cream for butter making were of doubtful value. Butter made from cream carbonated at churn-

ing had a sour taste when fresh, but this taste disappeared in a few days. Butter stored in a carbon dioxide atmosphere had its keeping qualities improved because of prevention of certain undesirable flavors and of surface molds. Mold growth on cheese was prevented by similar storage.

The results indicate that in general carbonation of dairy products did not prevent and, in most cases, did not retard to any great extent the deterioration of dairy products. In some cases carbonation changed the character of deterioration and in other cases caused a delay or inhibition in the development of certain off flavors.

The effect of the hydrogen ion concentration on the churning time of cream, E. S. Guthrie and P. F. Sharp (*Jour. Dairy Sci., 14 (1931), No. 1, pp. 1–13, figs. 4*).—In a study undertaken at the New York Cornell Experiment Station, cream containing 40 per cent fat was diluted with distilled water to 30 per cent cream for controlled churning and to 30 per cent with appropriate amounts of hydrochloric acid, sodium hydroxide, or acid or alkali plus salt to give the pH desired. Further efforts were made to study the effect of casein on churning time by varying the degree of dispersion of the casein. The cream in the various tests was churned under as nearly identical conditions as possible, and both washed and unwashed creams were used.

The results indicated that hydration or dispersion of the casein was associated with a lengthening of the churning time, and that dehydration or precipitation was associated with a shortening of the churning time.

Standardization of milk for the manufacture of American cheese, W. V. Price and L. Germain (*Wisconsin Sta. Research Bul. 108 (1931), pp. II + 11, figs. 2*).—This study was undertaken to determine the effect of standardizing milk on the quality of the cheese made from it, on the process of cheese making, and on the returns to the cheese factory. Lots of milk weighing approximately 425 lbs. each were used in three groups, and to one portion of each group was added sufficient skim milk to establish a ratio of casein to fat of 0.7 to 1. The second portion was used as a control. Each vat was made into American cheese, and the cheese in each lot was scored at the age of 14 days and 2, 6, and 12 months.

It was found that standardizing the milk to the casein-fat ratio used in this study decreased the yield of cheese per 100 lbs. of milk, increased the moisture, and decreased the fat content of the cheese, lowered the quality of the cheese slightly, and increased the value of the products obtained from a unit quantity of milk. The effect of standardizing was most noticeable when the milk had a fat content higher than 3.5 per cent and disappeared when the fat content was approximately 3.3 per cent.

The utilization of dry skim milk in the manufacture of ice cream and cream cheese, J. C. Marquardt (*New York State Sta. Tech. Bul. 174 (1931), pp. 24*).—This investigation was started to secure additional information regarding some of the properties and uses of dry skim milk, especially as related to the manufacture of ice cream and cream cheese. An effort was made to correlate the quality of fresh dry skim milk with its quality and usableness when stored at different temperatures and under different conditions. Three types of dry skim milk were divided into lots of equal amounts and stored at either 40 or 70° F. in sealed and unsealed containers.

The dry skim milk was stored for 8 months in sealed containers at both temperatures without any deleterious effect on flavor or solubility, but some deterioration occurred when the product was stored in unsealed containers. The ice cream made with dry skim milk stored in sealed containers for several months had good keeping quality, but it was not possible to make good ice

cream when the dry skim milk was kept unsealed for 60 days. The effect of dry skim milk on the quality of cream cheese was similar to that on ice cream.

The age of the ice cream and cream cheese made with good quality fresh dry skim milk was of more importance in affecting flavor than the history of the dry skim milks or their characteristics. The structural changes in dry skim milk of known history could be observed by the aid of a microscope, but a picture could not be drawn of the history of an unknown dry skim milk by the same method. There was no uniform decrease in the solubility of different dry skim milks due to exposure to light and air. Hydrogen-ion concentrations indicated that dry skim milk changed slightly toward the acid side during storage. The insoluble portion of a highly insoluble dry skim milk was generally composed of casein but might be a combination of protein and lactose, and the proportion of these latter constituents present in the insoluble portion was not a constant value.

VETERINARY MEDICINE

[Report of the department of veterinary science], J. B. LENTZ ET AL. (*Massachusetts Sta. Bul. 271 (1931), pp. 280, 281*).—A report made by H. Van Roekel, K. L. Bullis, G. L. Dunlap, and O. S. Flint of work conducted under the Poultry Disease Elimination Law includes an account of the control work with pullorum disease, a detailed report of which has been noted (E. S. R., 63, p. 577). Blood samples to the number of 21,123 from 37 flocks were tested with *Bruoella abortus* antigen in 1 to 25 and 1 to 50 dilutions with negative results. *Salmonella pullorum* was observed to remain viable on a dry piece of cloth in a Kolle flask for 14 weeks and possibly longer.

In reporting upon laboratory service in pathology by Dunlap mention is made of an especially virulent strain of *S. pullorum* isolated from mature stock and studied which produced death in 2 birds injected intravenously with 0.2 cc. of broth culture in 17 and 18 days, respectively, and the organism was again recovered. Two birds inoculated intratracheally with 0.5 cc. of broth culture were made visibly sick for a period of a week, but recovered. The primary lesion produced in these cases was a pericarditis.

Brief mention is made by C. S. Gibbs of infectious tracheitis in poultry found to be due to a filtrable virus. "The virus has been demonstrated in the tracheal exudate and in the secretions from the kidneys of diseased birds. Some of the birds recovering from infectious tracheitis have been found to persist as apparently healthy immune carriers. The viability of the virus is prolonged by freezing and drying. Studies on secondary invaders in infectious tracheitis have been made, and a laryngotracheal spirochete has been discovered. As far as is known at this station, this microorganism has not been observed before in poultry in the United States."

Annual report of the Civil Veterinary Department, Punjab, for the year 1929–30, T. F. QUIRKE (*Punjab Civ. Vet. Dept. Ann. Rpt. 1929–30, pp. V+5+35+XX, pls. 6*).—Included in this report (E. S. R., 62, p. 875) is a discussion of the diseases among livestock, their prevention and treatment (pp. 17–23), and a report of veterinary education (pp. 24–29). Tables are given showing the number of animals treated during the year.

The effect on the virulence of Bact. aertrycke of cultivation in atmospheres containing varying proportions of oxygen, G. S. WILSON (*Jour. Hyg. [London], 30 (1930), No. 4, pp. 433–467, figs. 12*).—This paper records a series of experiments in which an attempt was made to determine the effect, on the

virulence of *Bacterium aertrycke*, of cultivation in atmospheres containing varying proportions of oxygen.

Differentiation of the species of the genus Brucella, I. F. HUDDLESON (*Amer. Jour. Pub. Health, 21 (1931), No. 5, pp. 491–498*).—This paper reports upon work noted from another source (E. S. R., 62, p. 75).

The intermediate zone phenomenon encountered in certain Br. abortus agglutinating sera, F. W. PRIESTLEY (*Jour. Path. and Bact., 34 (1931), No. 1, pp. 81–89, fig. 1*).—The author reports upon investigations made of a curious zone of inhibition seen in certain sera from cattle affected with infectious abortion. In work at the Research Institute in Animal Pathology of the Royal Veterinary College at London, the following points were demonstrated: "The position of the zone depends upon the ratio between the amount of serum and organisms. Filtration through bacteriological filters causes the zone to widen in the direction of stronger concentrations of serum. Heat (56° C.) in the absence of organisms widens the zone, but in the presence of organisms it causes the zone to narrow. The marked effect of saline in varying concentrations upon the zone has been demonstrated. Experiments point to the zone being due to an insufficient reduction of potential on the bacteria in the dilutions within the zone."

The effect of killed cultures and filtrates of Brucella abortus in the prevention of infection in guinea-pigs, R. GWATKIN (*Jour. Infect. Diseases, 48 (1931), No. 4, pp. 381–403, figs. 18*).—In the first experiment conducted by the author, here described, guinea pigs were infected by feeding a suspension of *B. abortus* and also by instilling 1 drop into the eye, the lesions resulting being the same as those produced by intraperitoneal injection.

"Four experiments were then carried out in which groups of guinea pigs were given injections, in some cases by the subcutaneous and in others by the intraperitoneal route, of killed suspensions and filtrates of *B. abortus*. The agglutinin responses were recorded weekly throughout the experiments, and in one experiment 10 daily bleedings were made. The titer produced by any of these preparations did not exceed 1:500, and with some of the filtrates was low. The serums of these animals were shown, with one exception, to have as high complement-fixing qualities as those of the animals treated with the bacterial suspension. In the second experiment the infecting dose was insufficient, as shown by the controls, but the groups treated with the heated suspension and with the unheated filtrate, respectively, developed well-marked lesions. In the third experiment, in which the same immunizing agents were employed as in the second and in which the infecting dose was increased, all guinea pigs presented well-marked lesions and gave no evidence of protection. The only pregnant animal used in this experiment aborted 3 weeks after infections, and *B. abortus* was recovered from the placenta. In the fourth experiment (with ground bacterial extract and suspension) the results were not as clear-cut, but all animals showed changes in the spleen and *B. abortus* was recovered from this organ in all cases. In the fifth experiment, in which a formaldehydized suspension was employed, there was no evidence of protection from 30 injections. Lesions were as well marked as in the controls."

Search for a Brucella bacteriophage, R. GWATKIN (*Jour. Infect. Diseases, 48 (1931), No. 4, pp. 404–407*).—In the work here reported five samples of feces from infected and four from uninfected cows were examined for the presence of *B. abortus* bacteriophage. Nine samples of milk from infected and four from uninfected animals were also examined. One infected fetus, uninfected twin fetuses, six apparently normal fetal membranes, and three samples of blood from infected cattle were likewise tested for the presence of a lytic agent by

methods that had proved successful for the isolation of *Salmonella pullorum* bacteriophage from fowl. There was no evidence of bacteriophage in the material examined. Agglutination was produced by the filtrates of blood and of some of the milk samples from infected cows. Poor growth or absence of growth on the surface of liver agar seeded with *B. abortus* was shown to be due to water of condensation on the medium. Flasks that gave no growth when seeded while wet produced an abundant yield when reseeded after drying. No lytic agent could be demonstrated in the clear, or in the partially inhibited, areas. Attempts to lyse *B. abortus* with *S. pullorum* bacteriophage were unsuccessful.

Observations on Salmonella agglutination and related phenomena, P. B. White (*Jour. Path. and Bact., 34 (1931), No. 1, pp. 23–37*).—The author finds that, "in concentrations from 1:20 upwards, fresh normal rat and rabbit sera have the power of inhibiting specific somatic agglutination of Salmonella bacilli and, with certain probably partial exceptions, of coliform and Proteus bacilli. Normal guinea pig serum appears to possess similar properties, but far more generally than is the case with rat and rabbit sera is its inhibitory action complicated by a normal agglutinative effect (conglutination)."

A member of the Salmonella group causing abortion in sheep, R. Lovell (*Jour. Path. and Bact., 34 (1931), No. 1, pp. 13–22*).—A report is given of studies made of the morphology, cultural and fermentation reactions, and antigenic structure of several strains of *Bacterium abortus ovis*, a Salmonella organism causing epidemic abortion in sheep.

"The British strains and the one of German origin ferment dextrose, maltose, mannite, xylose, and dulcite with the production of gas. All strains studied fail to attack lactose, sucrose, salicin, inosite, rhamnose, and, with rare exceptions, arabinose. All strains produced H_2S slowly. The antigenic structure of the five British and one German strains appears to be identical. As regards the 'H' (flagellar) agglutinogens, *B. abortus ovis* is diphasic. The main component of the type phase is shared with *B. paratyphosum* C. With regard to the group phase, an important factor is shared with *B. paratyphosum* C and the related varieties, but there is also an additional component which appears to be peculiar to *B. abortus ovis*. The 'O' (somatic) antigens are shared with *B. abortus equi* and the Reading and Derby types. One of the minor factors is shared with *B. enteritidis*."

The viability of B. tuberculosis (bovinus) on pasture land, in stored faeces, and in liquid manure, R. S. Williams and W. A. Hoy (*Jour. Hyg. [London], 30 (1930), No. 4, pp. 413–419*).—It was found that under ordinary conditions in the south of England *B[acillus] tuberculosis* may remain alive and virulent in cow's feces exposed on pasture land for at least 5 months during winter, for 2 months during spring, and for 4 months during autumn. In summer no living organisms were demonstrated after 2 months, although under special conditions, e. g., protection from direct sunlight, the survival period may be 4 months during summer. In autumn feces protected from earthworms, etc., yielded bacilli after 6 months. Living and virulent *B. tuberculosis* were found after 12 months' storage in the naturally infected feces, and for a period of at least 2 years in the artificially infected feces. Living and virulent *B. tuberculosis* were found in stored liquid manure at least 4 months after infection. During this time a gradual diminution of the virulence of the material was observed.

Limitations of phenol coefficient tests in determining germicidal activities, G. F. Leonard (*Jour. Infect. Diseases, 48 (1931), No. 4, pp. 358–365*).—It is pointed out that while the regular phenol coefficient test is useful in determin-

ing the germicidal activity of products that are chemically related to phenol, this test has its limitations when applied to silver preparations or to other products that have high bacteriostatic action. By adding the transfer test to the regular phenol coefficient test, one can readily determine what products are actually germicidal and which have only a restraining effect on bacterial growth.

A method known as the G-R Test has been devised for determining the antiseptic or growth-restraining action of various products, and is here described. It is applicable even though the test material clouds the medium, as occurs with certain silver preparations. Both the mild and strong silver protein preparations have high bacteriostatic action, restraining typhoid and staphylococcus cultures in dilutions of from 1:5,000 to 1:20,000. Colloidal silver iodide preparations have a feeble bacteriostatic action, restraining growth only in dilutions of 1:50 or 1:100.

The poisoning of ruminants by Cestrum parqui [trans. title], J. Descazeaux (*Compt. Rend. Soc. Biol. [Paris], 105 (1930), No. 28, pp. 240, 241*).—*C. parqui*, a solanaceous shrub known as the willow-leaved jessamine, grows sometimes in abundance on the prairies in the central part of Chile near the cordillera, where it is poisonous to livestock. Cattle introduced from Argentina are poisoned, but native cattle refrain from eating it and thus escape. The author has found that 800 gm. of the leaves are fatal to 1.5-year-old sheep as are 3 kg. to the adult bovine. The fruit is much more toxic, 40 gm. causing the death of sheep and 100 to 150 gm. the death of the adult bovine. The course of the affection is rapid, and no treatment is possible.

Sex hygiene and reproduction of cattle, W. W. Williams (*Springfield, Mass.; Author, 1930, pp. XVI+252, pl. 1, figs. 55*).—This practical work furnishes the breeder and dairyman with a rational and systematic plan for the prevention and control of breeding losses among their cattle.

Bacterial growth in the udders of living cows compared with that in the udders following death and removal of the blood supply, H. R. Curran (*Jour. Infect. Diseases, 48 (1931), No. 4, pp. 408–412*).—It was found that "some bacterial types maintained in the udders of living cows at a fairly constant numerical level multiplied with great rapidity immediately following the death of the cows and removal of the blood. Rapidly growing invasive types of streptococci were most affected. The flora of the udders of some cows did not increase appreciably during the post-mortem incubation period. Relatively inert, slow-growing micrococci and streptococci usually comprised this group. The suddenly increased multiplication of the flora of the udders that frequently attends the withdrawal of the blood suggests that the circulatory system is directly or indirectly associated with the formation of the bactericidal substance in milk."

The blood picture of cattle affected with distomatosis [trans. title], E. Eichler (*Prager Arch. Tiermed., 10 (1930), A, No. 1–2, pp. 45–56; abs. in Vet. Rec., 11 (1931), No. 12, pp. 310, 311*).—In this contribution on the hematology of bovine diseases in general and distomatosis in particular, the author concludes that the blood examination is of little value in its diagnosis, since other current diseases may influence the blood picture, and that the simpler and reliable fecal examination may better be used. A list is given of 37 references to the literature.

The hemoglobinuria of bovines [trans. title], A. Sordelli, M. Prado, and J. J. Ferrari (*Compt. Rend. Soc. Biol. [Paris], 105 (1930), No. 29, pp. 312–314*).—In this contribution from the Bacteriological Institute of the National Department of Hygiene of Buenos Aires and the Bacteriological Institute of Chile, the authors report upon studies of an organism isolated from cases of

hemoglobinuria of cattle. This disease is found in Chile among cattle and sheep, principally in the Santiago region and in certain southern regions of the Argentine Andes, and the name infectious hemoglobinuria has been applied to it by B. Sanz,[2] who furnished the authors with material from two bovines that had succumbed.

Two varieties of *Bacillus perfringens* and another anaerobe termed by the authors "*Bacillus* sp. (?) 10" were isolated from the first, and a unique "*Bacillus* sp. (?) 14" from the second, of the two bovines, in the livers of which necrotic foci were found and in which the pathogene appears to be localized. The characteristics of the varieties, 10 and 14, of *Bacillus* sp. (?) are described, the organism implicated being found to differ from the *Clostridium hemolyticus bovis* described by Records and Vawter from Nevada (E. S. R., 56, p. 278).

The nature of louping-ill, J. R. Greig et al. (*Vet. Rec., 11 (1931), No. 13, pp. 325–333*).—The authors find that "clinical and other evidence suggests that parturient hypocalcemia is to be recognized as among the several diseased conditions confused with louping-ill in the field. The histopathology of louping-ill is represented by a meningo-encephalomyelitis suggestive of that caused by a neurotropic virus. The evidence upon which this conclusion is based is the subject of a separate publication. The causal factor of louping-ill has been found to be a filtrable virus. The disease can be produced in the mouse, and with much less certainty in the rat, by intracerebral inoculation, and can be retransmitted from these animals to the sheep. The rabbit and guinea pig were found to be refractory to infection.

"The results of the 1929 experiments in the transmission of louping-ill have been confirmed, in that it has been possible to effect the regular transmission of the disease in sheep by the intracerebral inoculation of material prepared from the brain and spinal cord. The blood of affected sheep was also found to be infective. The experimental transmission of louping ill to the pig was confirmed. It was again found that infection could also be produced by intraspinal and subcutaneous inoculation, but failure to infect by ocular installation and intraocular injection in a limited number of test animals is recorded. Sheep which withstood intranasal insufflation, intradermal, and subcutaneous inoculation of infective material were protected against subsequent intracerebral inoculation of virus. Means whereby sheep may be protected against the natural disease are thus indicated.

"The immunity induced in experimental sheep has been found to possess a duration of at least 11 months. It was found that a febrile reaction can be experimentally induced in sheep by infesting them with ticks collected from infected pastures and also by the serial inoculation of sheep with blood obtained from these tick-infested sheep, but the reaction obtained did not protect against the subsequent intracerebral inoculation of louping-ill virus."

Urinary calculi in sheep, B. E. Pontius, R. H. Carr, and L. P. Doyle (*Jour. Agr. Research [U. S.], 42 (1931), No. 7, pp. 433–446, figs. 4*).—This is a joint contribution by the departments of animal husbandry, chemistry, and veterinary science of the Indiana Experiment Station. A review of the literature is said to indicate that the calculi are usually produced by formations of calcium carbonate, calcium and aluminum phosphates, aluminum silicate, together with kidney tissue urates, epithelium, etc. In an attempt to obtain data on the prevalence of urinary calculi in sheep a questionnaire was sent to 53 prominent sheepmen in different parts of the United States and southeastern Canada. Of

[2] Inst. Biol. y Estac. Expt. Soc. Nac. Agr. [Santiago] Mem., 7 (1927), pp. 25–27.

the 45 replies received only 8 sheepmen had had no calculi trouble in their flocks. A report is given of the frequency of occurrence of calculi in sheep, observed cases of calculi, an autopsy report, size and composition of calculi, symptoms, recurrence of attacks, preliminary observations and experiments, and feeding experiments.

Twelve well-defined cases of calculi were observed and studied during the past 5 years in the Purdue purebred flock. Fifteen western feeding lambs, from four different farms, that were brought to the veterinary clinic of the station for post-mortem diagnosis had calculi. During the winter of 1929–30, 15 cases were observed among the 224 western feeding lambs being fed experimentally at the station, of which 5 died from calculi during the feeding period. Of the remaining 219 which were autopsied when slaughtered, 10 had calculi, and in 67 others evidence was found of irritation in the urinary tract which strongly suggested either that calculi had been present and had passed out with the urine or that the conditions which prevailed in the urinary tract were conducive to the formation of calculi. However, this was the first time that any appreciable amount of this trouble had been observed in feeding lambs at the station during 17 years of sheep-feeding trials.

"Calculi were found in the kidneys, the ureters, the bladder, and the urethra, but in only a few cases were they found in all of these parts in the same sheep. The calculi obtained and analyzed were composed largely of calcium phosphate and organic matter. They varied widely in size and in degree of hardness. Calculi were found more often in the processus urethrae (worm) than in any other part of the urinary tract. The S-curvature of the urethra in male sheep offers a mechanical difficulty which frequently prevents the passage of calculi beyond this point. This is the place where large calculi are most likely to lodge and cause complete stoppage. Partial or complete inability to urinate is the most positive symptom of calculi formation. When calculi are present the wool around the end of the sheath is invariably wet. In severe cases the back becomes arched because of the great effort required to urinate. If the calculus is in the worm, and the worm is removed, recovery is rapid. The writers do not know of a successful method of dislodging large calculi from the S-curvature of the urethra. It was found that one attack was likely to be followed by a second or a third attack. In no instance did the animal survive the third attack.

"Experiments were made to determine how different rations would affect the reaction or composition of urine. These experiments were conducted largely with wethers and ewes 1 year old and older, and covered a period of over 2 years. Forty-two different sheep were used, and 104 samples of urine were collected. When roots were fed, 2,200 to 2,500 cc. of urine per sheep were produced in 24 hours, whereas from sheep on dry feed the average production was only 200 to 250 cc., but pasture increased this amount to about 600 cc. per half day. The reaction of the fresh urine varied from pH 6.8 to 9.0, depending on the feed of the animal. Sheep on alfalfa or beet rations produced a very basic urine ash, but when a cereal grain or bran was added to the ration the reaction of the urine was *nearly neutral. The presence of the enzyme urease in* urine also is responsible for it becoming basic rapidly upon standing due to the formation of ammonium carbonate from urea. This accounts for part of the large deposits of organic residues formed as the enzyme action continues making the urine much more basic. When the ration was utilized to best advantage by the sheep, about 3 per cent of solids were found in the urine. On the most undesirable rations the sheep produced a urine containing 6 to 8 per cent of solids, which indicates a large waste of nutrient material. Moreover, the urine ash was highly basic. It seems probable that such urine would irritate

the urinary tract and thus account for the observed cases of marked inflammation of the urethra in the absence of calculi. When sheep were fed alfalfa or clover hay or roots alone a highly basic urine was produced. Certain mineral compounds are sometimes precipitated from the urine and the crystals cluster around an organic nucleus, which results in the formation of calculi."

Histological studies on hog cholera.—I, Lesions in the central nervous system, O. Seifried (*Jour. Expt. Med., 53 (1931), No. 2, pp. 277–287, pls. 3*).—This is a contribution from the department of animal pathology of the Rockefeller Institute for Medical Research. A more or less marked encephalomyelitis and meningitis was found by the author in 33 out of 39 cases of virus hog cholera, which had been infected either intramuscularly or by contact and killed between 6 and 49 days after infection.

Subcutaneous emphysema in operated and unoperated fowl, L. V. Domm (*Poultry Sci., 10 (1931), No. 3, pp. 120–124, fig. 1*).—This is a report of a study made of subcutaneous emphysema, which results from puncturing the balloon-like air sacs in performing surgical operations in the domestic fowl requiring the opening of the abdominal cavity and which it is practically impossible to avoid.

Collyriclum faba as a parasite of poultry, W. A. Riley (*Poultry Sci., 10 (1931), No. 4, pp. 204–207, fig. 1*).—In this contribution from the Minnesota Experiment Station, it is pointed out that the occurrence of Collyriclum cysts on domesticated fowls was not reported in the literature until 1924, when Kernkamp and the author recorded its occurrence in a single flock, each, of chickens and of turkeys, in widely remote localities in Minnesota (E. S. R., 51, p. 385). In the present account six additional centers in Minnesota are recorded. Until there is some evidence to the contrary, it is assumed that they develop in snails in the manner typical of the group. Accumulated evidence is said to point very definitely to the nymphs of dragon flies as the second intermediate host of the fluke *C. faba*.

Observations with a new transmissible strain of the leucosis (leucemia) of fowls, J. Furth (*Jour. Expt. Med., 53 (1931), No. 2, pp. 243–267, figs. 2*).—The author finds that myeloid leucosis and erythroleucosis can be transmitted from one bird to others by emulsions of infiltrated organs, whole blood cells, and plasma. "Inoculation is more often successful with blood cells or with whole blood than with plasma or with emulsions of organs infiltrated as the result of leucosis. Inoculation with material from a bird with myeloid or with erythroleucosis produces both myeloid and erythroleucosis, and in many instances mixed forms with characters of both. Evidence is wanting that lymphoid leucosis is caused by the agent that transmits myeloid and erythroleucosis. The occurrence of lymphoid leucosis among the birds inoculated with material from myeloid or erythroleucosis may be explained as spontaneous disease. Injury to cellular structure by treatment with distilled water or by repeated freezing and thawing does not destroy the agent that transmits the disease. Berkefeld filtrates have failed to transmit regularly myeloid or erythroleucosis. The evidence obtained shows, however, that the transmissible agent is filtrable, although there are technical difficulties in its filtration."

Transmission experiments with leucosis of fowls, E. L. Stubbs and J. Furth (*Jour. Expt. Med., 53 (1931), No. 2, pp. 269–276*).—It is shown, in a carefully controlled experiment, that fowl leukemia can be readily transmitted from chicken to chicken by injection.

Avian pox immunization, Z. Morcos (*Vet. Rec., 11 (1931), No. 17, pp. 463–465, figs. 6*).—In work in Cairo, the author found that 0.002 formolized pigeon virus emulsion is protective to both fowls and pigeons. The blood of an

infected bird is infective. It is concluded that the fowl pox virus is not pathogenic to guinea pigs and white rats on intradermal inoculation; sparrows fed on the virus do not show any apparent lesions. Doves contract pigeon pox, and the dove virus does not protect pigeons but is infective.

Septicemic Salmonella pullorum infection in adult fowls, R. P. Tittsler (*Poultry Sci., 10 (1930), No. 1, pp. 17–23*).—In this contribution from the Pennsylvania Experiment Station the author reports that numerous outbreaks of *S. pullorum* infection in adult fowls have come to his attention in the past few years, most of the cases occurring in December, January, and February in pullet flocks. It is pointed out that the actual economic importance of the septicemic infection in pullets is difficult to estimate, it not being comparable to that in baby chicks either from the standpoint of number of outbreaks or the percentage of individuals affected. Thus, during the period when 18 cases in adults came to attention, some 300 cases were found in baby chicks. While a mortality of from 50 to 90 per cent is not at all uncommon in baby chicks, only 5 of the 18 cases resulted in losses over 15 per cent and in no case did it exceed 40 per cent. The possible transmission of the disease from acute outbreaks in adults to chicks is called to attention, it being not improbable that such takes place, since usually one attendant cares for both old and young stock. The author emphasizes the importance of sterilizing nonfertile incubation eggs when used for feed, since in the past they frequently have been a source of acute outbreaks of the disease.

On the bacteriology and pathology of 500 chicks affected with pullorum disease, M. W. Emmel (*Poultry Sci., 10 (1930), No. 1, pp. 24–30*).—In studies conducted at the Michigan Experiment Station, here reported, the author has found that "except in acute forms of pullorum disease in baby chicks there is a definite pathology produced upon which the disease can be diagnosed. Gray and brown foci, petechiae, and hemorrhagic or congested areas may occur in the liver; gray foci, pneumonia, and congestion are the lesions produced in the lungs; firm, nodular, gray foci may appear in the musculature of the heart. Combinations of any of the lesions of the liver or lungs may occur."

If two or more chicks from a flock showing symptoms are submitted for diagnosis, the disease can usually be diagnosed on the gross lesions, but if individual chicks are submitted, it may be necessary to resort to bacteriological methods to diagnose the disease. Lesions of the liver, heart, and lungs were associated in 32.4 per cent of the chicks; liver and lung lesions in 39.6 per cent; and liver lesions alone in 15 per cent. The causal organism was isolated from the liver of 89.2 per cent, from the lungs of 84.2 per cent, and from the heart of 74 per cent of the 500 chicks studied.

Incidence of Salmonella pullorum in eggs from reactor hens, H. J. Weaver and J. C. Weldin (*Poultry Sci., 10 (1931), No. 3, pp. 118, 119*).—This is a report of bacteriological studies at the Rhode Island Experiment Station of infected eggs, conducted with a view to determining whether the *S. pullorum* organism is given off in the egg by the reactor periodically or at irregular intervals. It is concluded from the results obtained in a study of 20 reacting hens, 775 eggs from which were examined bacteriologically and the detailed results presented in tabular form, that there is no correlation between the percentage of infected eggs laid and the various phases of the clutch.

The effect of various concentrations of nicotine in tobacco on the growth and development of fowls.—I, A study of the nicotine tolerance of growing chicks, J. E. Hunter and D. E. Haley (*Poultry Sci., 10 (1930–31), No. 2, pp. 61–67, figs. 2*).—The feeding of tobacco for the control of intestinal parasites in fowls has led to this study at the Pennsylvania Experiment Sta-

tion of the nicotine tolerance of growing chicks. The work has shown that chicks can tolerate larger quantities of nicotine in tobacco than has hitherto been recommended, if a high nicotine strain of tobacco is used for this purpose.

AGRICULTURAL ENGINEERING

Note on research work done by the Special Irrigation Division since its formation in June, 1916, C. C. Inglis (*Bombay Pub. Works Dept., Tech. Paper 28 (1929), pp. [4]+36, pls. 2, figs. 36*).—This is a summary of the important points of several lines of hydraulic research conducted during the past 15 years by the Irrigation Division.

Report on land drainage experiments at Baramati, C. C. Inglis and V. K. Gokhale (*Bombay Pub. Works Dept., Tech. Paper 24 (1928), pp. [4]+19, pls. 27, figs. 2*).—A large amount of data on the results of land drainage experiments under irrigated and alkali conditions is presented and discussed. A large number of conclusions are also drawn.

Among other things, it was found that drains to be effective must be located in porous material and should cut through it to a considerable depth. Drainage takes place mainly along the layers of stratification and in the direction of the dip, and only to a very limited extent against the dip or normal to the stratification. Intercepting drains are only partially effective unless they are taken down to an impervious bed such as rock. Where the porous stratum is deep they have little effect, the pressure being transmitted through the deeper layers. Drains excavated down the slope are usually much more effective than those excavated normal to the direction of the slope of the ground. It is wise to err on the side of overdrainage rather than underdrainage, because once perennial irrigation has become established it is very costly and often very difficult to construct new drains or enlarge old pipe lines.

Where there is a fairly porous substratum, salts can be removed by merely flooding with 6 in. of water, for from 3 to 4 months, after shallow drains have been excavated in the vicinity of the flooded plats. Where drainage is poor, the addition of 1 ton per acre of finely ground gypsum before flooding is desirable. In the Dekkan drainage is generally possible, and wherever the damaged area is fairly concentrated and there is a reasonably contiguous outfall the cost of protecting areas does not exceed 50 rupees ($18.25) per acre. Where the substratum is moderately porous, reclamation is simple.

The influence of turbulence upon highest useful compression ratio in petrol engines, T. F. Hurley and R. Cook (*Engineering [London], 130 (1930), No. 3373, pp. 290–293, figs. 10; abs. in Sci. Abs., Sect. B—Elect. Engin., 34 (1931), No. 397, pp. 4, 5*).—Studies are reported which dealt with the promotion of different types of turbulence and the examination of the movement obtained while motoring the engine, and with the highest useful compression ratio resulting from the employment of the various types of turbulence observed. Experiments were made on a Ricardo variable compression, sleeve-valve engine of 2⅞-in. bore and 3¼-in. stroke. Any desired direction was given to the entering air by placing in the ports, near the sleeve, groups of thin curved parallel vanes. The motion of the air was deduced from observing the movement of sparks of burning material admitted with the air, by inspecting the movement of an oil film on the underside of a glass window inserted in the cylinder head, or by observing the movement of drops of water introduced into the entering air.

Photographs of the observations indicate that a rotational swirl once initiated tends to persist throughout the cycle. Admission through a single port induced

swirling about a vertical axis, and eddying turbulence was only observed when the air entered in two opposed streams, but was still accompanied by some degree of rotation. Evidence was obtained of the existence of an axis of low pressure in the cylinder. The highest value of the highest useful compression ratio was obtained with the air entering in an undisturbed tangential flow and was accompanied by a regular combustion knock, distinct from detonation, which was more or less observable throughout the tests; the lowest value occurred with eddying or indiscriminate turbulence.

A theory is advanced for the process of combustion which, if correct, would indicate that combustion chamber design should be modified so that part of the mixture near the sparking plug remains stagnant or in a state of indiscriminate turbulence, while the main body of the charge is given a definite unidirectional swirl.

The use of agricultural machinery in Canada and the United States of America, T. BAXTER, G. CLARKE, and J. E. NEWMAN (*[Gt. Brit.] Min. Agr. and Fisheries Bul. 27 (1931), pp. IX+38, pls. 12, fig. 1*).—This is a contribution from the National Farmers' Union, the National Union of Agricultural Workers, and the Institute of Agricultural Engineering of the University of Oxford, all of Great Britain. It presents the results of a first-hand study of the principal mechanical methods and equipment used in American and Canadian agriculture and an analysis of these in the light of the requirements of British agriculture.

Experience with buildings [trans. title], B. VON ARNIM (*Arb. Deut. Landw. Gesell., No. 376 (1930), pp. 103, figs. 86*).—This is a handbook of general information on farm building construction based on experience in Germany. It contains sections on building materials; roofs; towers; stalls for cows, calves, swine, horses, and colts; poultry houses; implement shelters; ice houses; dwellings; and fire protection.

Disposal studies for milk-products waste, E. F. ELDRIDGE (*Engin. News-Rec., 106 (1931), No. 13, pp. 520, 521, figs. 2*).—Studies conducted by the Michigan Engineering Experiment Station led to the conclusion that primary biological filtration is the most promising method of any yet devised. Fair sized experimental filters have reduced the unstable material in raw milk waste by as much as 93 per cent. The effectiveness of the treatment was found to depend upon a careful control of the strength and character of the waste, a factor which largely accounts for the lack of success with this method of treatment in the past.

The experimental units used for the studies consisted of a storage tank, orifice box, dosing tank, and filters of gravel, cinders, sand, and brush. The gravel filter was 10 ft. in diameter and 10 ft. deep and was composed of from 1.5- to 3-in. stones. Dosing was accomplished by means of a revolving-arm sprinkler. Gravel or crushed stone of about 1.5- to 3-in. grade makes the best filtering medium. The maximum rate of application for sand is 0.15 m. g. d. (million gallons per day) and for gravel or cinders 1 m. g. d. per acre.

The maximum biochemical oxygen demand value for the waste applied to a sand filter operated at the 0.15 m. g. d. rate is about 1,500 parts per million, and with gravel or cinders operated at 1 m. g. d., about 1,700 parts per million. If a higher rate is used the strength of the waste should be reduced accordingly. The depth of the filter depends largely upon the character of the effluent desired. For sand 30 in. is ample. Gravel and cinders require a much greater depth.

It is necessary to provide a storage tank with about 3- to 4-hour detention to smooth out the peaks in the volume and strength of the waste discharged from the milk plant. Provision should be made for draining and cleaning this

tank and for dilution of the waste if necessary. This dilution can be accomplished in many cases by diverting a portion of the condenser water into the waste to be treated. Where a vacuum pan is not in operation, direct dilution may be necessary if the strength of the waste is above the maximum recommended for effective filtration.

AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY

Influence of yield on costs and income in agricultural production, B. H. Frame (*Missouri Sta. Bul. 297 (1931), pp. 12*).—The influence of yield on costs of production and income from crops and livestock is discussed and illustrated by results of studies at different State agricultural experiment stations.

Investigation into farming costs of production and financial results, J. Wyllie (*Southeast. Agr. Col., Wye, Dept. Econ. Rpt. 8 (1930), pp. 213–288*).—This is a general report based on reports of results obtained from 25 farms in the counties of Kent, Surrey, East Sussex, and West Sussex, England, during the 6 years beginning at Michaelmas, 1923. The conditions in the area, the system of accounting used, and the methods of determining capital invested and annual profit and loss are discussed. General summaries are given of the findings regarding capital invested, expenditure, income, and change in valuations, and of the capital invested and financial results on individual farms. The results obtained for various branches of farming are being published in separate reports.

The estimated gross cash income from the sale of agricultural products from Ohio farms by counties, 1929, R. E. Straszheim and J. I. Falconer (*Ohio State Univ., Dept. Rural Econ. Mimeogr. Bul. 7 (1930), pp. [11]*).—A table is presented for 1929 similar to that previously noted for 1927 (E. S. R., 62, p. 678).

Sugar beet in the eastern counties, 1929, C. Burgess and P. E. Graves (*Cambridge Univ. Dept. Agr., Farm Econ. Branch Rpt. 16 (1930), pp. IX+70, figs. 8*).—This is the final report of the financial results and the principal factors influencing them in the eastern counties of England, and is based on cost records from 100 farms each in 1927 and 1928 and 95 farms in 1929. A statistical summary is included of material relating to the methods of growing and manuring and the yield, tare, and sugar content of beets on different types of soil; influence of time of delivery on sugar content; weather conditions; and different items of cost. The factors affecting costs and returns and the seasonal distribution of labor are discussed.

The results indicate that growers can deliver roots to the factories at a total cost of approximately 48s. ($11.66) per ton, or at a net cost of 40s. per ton, deducting for the residual values of the crop and the value of the tops.

Interim report of the Royal Grain Inquiry Commission, 1928, J. T. Brown, J. A. Stoneman, and W. J. Rutherford (*Regina, Sask.: Govt. [1929], pp. [51]*).—This report was made to the Lieutenant Governor-in-Council of Saskatchewan by the commission appointed November 10, 1928, to inquire into and report on the present method employed in grading wheat and whether its alteration or replacement would be advantageous to growers; the effect of the present system of mixing and grading upon the condition, quality, and price of wheat on domestic and other markets; the spreads between wheat of different grades and whether the spreads correctly indicate the comparative milling values; and the moisture content of wheat and its effect on storage, milling, and marketing.

Systems of dairy farming, W. E. Cole (*London: Col. of Estate Mangt., 1930, pp. XII+278, figs. 15*).—This is the report of the first scholar traveling in

agriculture appointed by the College of Estate Management, London, to study agricultural methods in England and abroad. It is based on a study of 172 dairy farms in Great Britain and data gathered during about 12 months spent in the leading dairy countries of continental Europe. The status of the industry in Great Britain and in general; farm, herd, and cow management; and the economics of dairy farming are discussed.

An agricultural program for the irrigated region of northern Colorado, T. H. SUMMERS (*Fort Collins: Colo. Agr. Col. Ext. Serv., [1930], pp. 70, figs. 8*).—Included are the recommendations of the committees for the several agricultural products, irrigation and drainage, and farm organization of the economic conference held at Greeley, Colo., February 13 and 14, 1930.

The five-year plan of the Soviet Union, G. T. GRINKO (*London: Martin Lawrence, 1930, pp. 339, pls. 8, figs. 2*).—The purpose of this volume is to present the five-year plan, the variety and scope of the problems, the processes being used, and the actual experiences of the first and second years. The several chapters deal with the planned economy and perspective planning in the Union of Socialistic Soviet Republics, the achievements of the rehabilitation period and the economic conditions at the beginning of the five-year plan, the principles and the general line of development, prospects of industrial development, socialist rationalization and the workers, agricultural advancement and socialist reorganization in the villages, the worker-peasant bloc and the economic development, the perspective of transportation, housing and city planning, the problems of skilled personnel and the cultural uplift of the masses and of equilibrium during the five-year period, the interregional division of labor, and the future.

International control of raw materials, B. B. WALLACE and L. R. EDMINSTER (*Washington, D. C.: Brookings Inst., 1930, pp. XV+479, figs. 13*).—This volume discusses the Chilean control of sodium nitrate, the Japanese camphor monopoly, the Franco-German potash combine, Brazilian control of coffee, British rubber export restrictions, Canadian embargoes on pulpwood, colonial discriminatory export duties, American practices regarding domestic raw materials, the equitable treatment of foreigners, relief through national action in the United States, and the international approach to the subject.

Reasonable livestock commission rates, G. N. DAGGER and H. D. DOZIER (*Jour. Land and Pub. Util. Econ., 7 (1931), No. 1, pp. 45–51*).—This is a review of the case of Tagg Bros. and Moorhead v. United States (280 U. S. 420), upholding the power of the Secretary of Agriculture to fix livestock commission rates and the schedule of rates fixed for the Omaha (Nebr.) market.

Report on the marketing of dairy produce in England and Wales.—Part I, Cheese (*[Gt. Brit.] Min. Agr. and Fisheries, Econ. Ser. 22 (1930), pp. 153, [pls. 29], figs. [5]*).—Included are a preliminary survey of the types and varieties of cheese and the cheese-making areas, farm and factory cheese making, and the demand for and supplies and prices of cheese in England and Wales; and discussions of the problem of quality, grading, and manipulative operations in preparing cheese for market; country wholesaling; distribution by importers, town wholesalers, and retailers; publicity in marketing; transportation and storage of cheese; and the use of whey.

Financial operations of Ohio farmer owned elevators during the fiscal year 1929–30, B. A. WALLACE (*Ohio State Univ., Dept. Rural Econ. Mimeogr. Bul. 28 (1930), pp. [2]+14, fig. 1*).—Tables having the same character as those previously noted (E. S. R., 63, p. 484) and covering the fiscal year 1929–30 are presented and discussed, and comparisons are made with the previous report. The tables are based principally on balance sheet and income and ex-

pense items from 144 companies operating 168 plants, detailed analysis of the expense items of 52 companies, commodity sales and margins from 40 companies, and the monthly charges, collections, and balances of accounts receivable from 17 companies from January, 1925, to December, 1929.

Grain (*Fed. Farm Bd. Bul. 5 (1931), pp. I+45*).—Information is given to assist in the organization of local cooperative associations so that they may obtain the benefits authorized under the Agricultural Marketing Act. The requirements of the Capper-Volstead Act, the procedure for reorganizing existing associations and organizing new associations, the legal structure, and the conditions affecting the success of such organizations are set forth, together with forms for subscription and marketing agreements, articles of incorporation, by-laws, waiver and consent agreements, and minutes.

Factors affecting sweet potato prices in Missouri, F. L. THOMSEN and W. R. FANKHANEL (*Missouri Sta. Bul. 302 (1931), pp. 20, figs. 13*).—Correlation analysis is made of the factors affecting the prices, production, and acreage of sweetpotatoes and the difference in price between the dry and moist types of sweetpotatoes. The possibilities for the development of a commercial sweetpotato industry in certain sections of north Missouri are discussed.

The production of sweetpotatoes and the price of white potatoes were found to account for 93.9 per cent of the annual price variations of sweetpotatoes during the period 1921–1929, the individual percentages being 60.6 and 33.3, respectively. Acreage accounted for 69 per cent and yield per acre for 29.8 per cent of the variations in production, and sweetpotato and cotton prices for the changes in acreage, 1921–1927. Of the price margin between the dry and moist flesh types of sweetpotatoes, 97.76 per cent was accounted for by the price of white potatoes and the ratio of production in the dry-type States to that in the moist-type States.

The study indicates that the outlook is favorable for the industry in certain sections of north Missouri for the dry type of sweetpotatoes, that Missouri has an advantage over the principal Jersey type producing sections in freight rates to Chicago and cities west of Chicago, but that the shipments of uncured sweetpotatoes from Missouri would reach the markets during the peak movement from other sections.

Factors affecting the price of potatoes in Great Britain, R. L. COHEN (*Cambridge Univ. Dept. Agr., Farm Econ. Branch Rpt. 15 (1930), pp. IV+55, figs. 8*).—This is a study covering the period 1885 to 1929, inclusive, of prices, acreage, yields, production, and imports to determine to what extent the price movements were explicable by economic theory.

Pool, cartel, monopoly, and duty as means of raising the prices of agricultural products [trans. title], O. MIELCK (*Ber. Landw. Reichsmin. Ernähr. u. Landw. [Germany], n. ser., 11 (1930), No. 2, pp. 201–234*).—Price raising as compared with other methods of increasing the returns to agriculture, and cooperative pools, cartels, monopolies, and duties as means of raising prices, are discussed.

International price movement and the condition of agriculture in the nontropical countries [trans. title], M. SERING (*Ber. Landw. Reichsmin. Ernähr. u. Landw. [Germany], n. ser., Spec. No. 11 (1929), pp. XV+230, pls. 12, figs. 35*).—The economic conditions of grain growing, 1875–1900 and 1900–1914; the international agricultural crisis, 1920–1924; price movement in Germany; the development, status, and outlook for agriculture in different countries; and the causes of the abnormal price situation of the leading agricultural products are discussed.

Included also are a discussion (pp. 133–161) of prices and the trends in world grain growing, by A. Schindler, and a summary (pp. 162–165), by

R. Lerch, of physical and other conditions affecting agriculture in the Union of South Africa and in the mandated territory of Southwest Africa.

1930 Handbook of the Netherland East Indies (*Buitenzorg: Dept. Agr., Indus. and Com., Div. Com., 1930, pp. XVI+424, pls. 7, figs. 167*).—This handbook, in its chapters on geographical situation and area, population, government, monetary system, agrarian legislation, commercial law, and shipping, includes sections on agriculture, agricultural banks, irrigation, drainage, flood control, cattle breeding, forestry, and education.

Problems in contemporary county government, W. Kilpatrick (*Va. Univ., Inst. Research in Social Sci., Inst. Monog. 8 (1930), pp. XXI+666*).—This publication of the Institute for Research in the Social Sciences, University of Virginia, is "an examination of the process of county administration in Virginia." The several parts deal with the organizing agencies for the performance of different functions, the operation of the financing process, the adaptation of the county to rural areas, the employment and compensation of officers, the erection, equipment, and cost of buildings, and the county in the context of government. A plan for reorganizing the structure of the county is outlined and discussed.

Research in public finance in relation to agriculture, edited by J. D. Black (*Social Sci. Research Council Bul. 1 (1930), pp. [4]+174*).—This is the first report in a series on scope and method in the various subfields of agricultural economics and rural sociology to be published by the advisory committee on social and economic research in agriculture. It was prepared by a special committee composed of J. D. Black, E. Englund, M. S. Kendrick, and R. W. Newton, and includes contributions from 23 agricultural economists of the U. S. Department of Agriculture, State universities, agricultural colleges and experiment stations, Harvard and Columbia Universities, and other institutions. It discusses the field of public finance in agricultural economics and its content and interrelations with other fields. It describes the research projects already undertaken and points out additional projects. It evaluates the methodology in use and suggests methods and procedures that may be used. Forty-five possible projects are analyzed, the object, scope, organization, qualitative analysis, sources of information, sampling, basic concepts and measures, collection and analysis of data, presentation of results, etc., being considered.

The tax situation in Illinois, H. D. Simpson (*Inst. Research Land Econ. and Pub. Util. [Chicago], Studies Pub. Finance, Research Monog. 1 (1929), pp. [10]+104, figs. 50*).—Analysis is made of the situation in Chicago and in the State outside of Chicago, a detailed study being made of La Salle, St. Clair, and Williamson Counties. The average level and general range of assessments in 1923 and the assessments by districts and classes of property and of homes in 1927 in Chicago, and the general level, range, and deviation from uniformity of assessments in 1926 and 1927 in the State and the three counties are discussed. Comparisons are made of the assessments of urban, village, and rural properties and of large and small properties in the State and the three counties. The causes of the inequalities and the results not susceptible of statistical measurement are also discussed. As remedies, centralization of administrative responsibility in both State and local assessment, full publicity of assessments, repeal of the quadrennial limitation, revision of the personal property tax, and a step toward State income taxation are suggested.

The part of the study concerned with Chicago was made largely under the auspices of the joint commission on real estate valuation, created by the Cook County Board of Commissioners in January, 1927. The other part was carried on in cooperation with the Illinois Joint Tax Conference, and much of the data

regarding sales was obtained from the Illinois Agricultural Association and the tax department of the Chicago and North Western Railway Co.

The tax situation in Morgan County, Illinois, H. J. Stratton (*Jour. Land and Pub. Util. Econ., 6 (1930), No. 4, pp. 372–375, fig. 1*).—This is a study similar to that of the three selected counties in the study noted above.

Some defects of current sale value as the basis for appraisal, V. P. Lee (*Jour. Land and Pub. Util. Econ., 6 (1930), No. 4, pp. 337–342, figs. 4*).—The defects of sale value as a basis for taxation of farm lands are discussed, and the following conclusions are reached: (1) Current sale value is not a good indicator of the price obtainable under foreclosure, (2) over a period of years the ratio of earnings to value varies widely, (3) the policy of advancing a fixed percentage of value in any given year on long-term loans is unwise, (4) current earnings are inadequate as a basis for loans, and (5) appraisal should be based on earnings for a period of years and on physical productivity and probable farm products prices over several future years.

Russian co-operative banking, N. Barou (*London: P. S. King & Son, 1931, pp. 82*).—The cooperative movement and credit cooperation in the Union of Socialistic Soviet Republics, the All-Russian Cooperative Bank (Vsekobank), the All-Ukrainian Cooperative Bank (Ukrainbank), the Moscow Narodny Bank, Limited, London, the Cooperative Transit Bank, Riga, and the U. S. S. R. and international cooperative banking are discussed.

Semi-annual index of farm real estate values in Ohio, January 1 to June 30, 1930, H. R. Moore (*Ohio State Univ., Dept. Rural Econ. Mimeogr. Bul. 31 (1930), pp. [1]+11, figs. 4*).—This report continues the series previously noted (E. S. R., 62, p. 483).

An average day's work on Ohio farms, F. L. Morison (*Ohio State Univ., Dept. Rural Econ. Mimeogr. Bul. 32 (1931), pp. [1]+13, fig. 1*).—Records were obtained from 744 schedules filled in in 1930 by junior and senior students in agriculture in vocational schools and their fathers. A table is included showing for each of the four districts of the State the operations and type and width of machinery used, the crew (men and horses), and the acres covered per 10-hour day in seed bed preparation and in raising and harvesting corn, small grains, hay, and potatoes, and the number of man hours per acre required for different operations to raise and crib a 55-bu. yield of corn with small units of horse-drawn machinery, with larger horse-drawn units, and with tractor-drawn machinery, except the planter. The total requirements for man labor were for small horse-drawn units 27.63 hours, larger horse-drawn units 20.19 hours, and tractor-drawn units 7.48 hours.

The cost of tractor work on the farm, M. A. Knox (*Jour. Southeast. Agr. Col., Wye, Kent, No. 27 (1930), pp. 209–213*).—This is a study of the costs on 9 farms covering 50 tractor years up to Michaelmas, 1929. The number of hours worked per year per farm varied from 271 to 1,293, averaging 740, and the cost per hour from 1s. 5d. to 4s. 5d., averaging 2s. 10d. Of the average total cost, 28.5 per cent was for depreciation, 24.4 per cent for repairs and renewals, 46.6 per cent for fuel and oil, and 0.5 per cent for sundries. It made little difference whether total costs for individual crops were based on hours worked or on fuel and oil consumption.

The post-ownership steps on the "agricultural ladder" in a low tenancy region, C. F. Wehrwein (*Jour. Land and Pub. Util. Econ., 6 (1930), No. 1, pp. 65–73, figs. 3*).—This is a further analysis in the study previously noted (E. S. R., 60, p. 886), particular attention being given to the combinations of steps in becoming owners and the "post-ownership steps," i. e., the stage of encumbered ownership.

Of the 192 farmers reared on farms, 90 went to ownership directly from working at home without wages, 30 had only the intervening step of rural, nonagricultural work, 20 only that of hired man, 6 only that of urban employment, and 7 only that of tenant. Twelve had the 2 steps rural, nonagricultural employment and hired man. The average size of farm for the 153 farmers for which comparisons could be made increased from 70.43 acres at the time of purchase to 90.37 acres for those owned for 45 years. The average mortgage debt per acre decreased from $50.66 at the beginning to $20.77 (110 farms) at the end of 15 years, $17.54 (46 farms) at the end of 30 years, $3.27 (15 farms) at the end of 40 years, and none had indebtedness at the end of 45 years.

The "agricultural ladder" in a high tenancy region, C. F. Wehrwein (*Jour. Land and Pub. Util. Econ. 7 (1931), No. 1, pp. 67–77, figs. 2*).—This is a study similar to that previously noted (E. S. R., 60, p. 886) and that noted above, with which comparisons are made. It is based on data from 92 farmers in Bradford Township, Rock County, Wis., a region with a high percentage of tenancy. Of the 92 farmers, 89 were reared on farms and 45 have become owners. Of the owners, 11 came to ownership directly from working at home without wages, 11 with the tenant step intervening, 6 through the hired man on other than the home farm and tenant steps, and 5 through the hired man on other than the home farm step alone. The size of farm for 38 of the owners increased from 130 acres at the beginning to 165.5 acres at the end of 35 years, but the size at the end of the intervening 5-year periods varied, the maximum being 182.65 acres at the end of 30 years. The average mortgage indebtedness per acre decreased from $65.58 at the beginning ($67.60 at the end of 5 years) to $26.95 (25 farms) at the end of 15 years, $21.02 (5 farms) at the end of 30 years, and $6.34 (2 farms) at the end of 35 years.

The comparison of the area included in this study and the low tenancy area of the previous study showed that it is harder and takes longer to acquire ownership in the high tenancy area because of the higher value of land, but that the opportunity to accumulate wealth was better on the higher value lands, as evidenced by the shorter encumbered-ownership stage.

Negro migration [from middle Georgia counties], J. W. Fanning (*Ga. Univ. Bul. 476 (1930), pp. 39, figs. 3*).—This is a study of the exodus of negroes between 1920 and 1925 as influenced or determined by existing economic conditions.

A glimpse of the social economics of Porto Rico, 1930, H. C. Sherman (*Jour. Home Econ., 22 (1930), No. 7, pp. 537–545; also in Porto Rico Jour. Pub. Health and Trop. Med., 6 (1930), No. 2, pp. 221–228*).—This general discussion of the social economic conditions responsible for the extreme poverty and inadequate food supplies of the majority of Porto Rican families is based upon a survey of practically the entire island in February, 1930. The principal nutritional problems of the Porto Rican people have already been noted from another source (E. S. R., 64, p. 287).

Evaluating certain equipment of the modern rural home, C. D. Clark (*Jour. Home Econ., 22 (1930), No. 12, pp. 1005–1015*).—This study was made in the Connecticut Storrs Experiment Station as a basis upon which to formulate a home equipment score for use in certain sociological research. Tables are given showing the means of the rank order of 10 items of home equipment given by 28 college and university teachers, 12 high school teachers, 9 faculty home makers, and 21 selected home makers, and of the weighted scores of the teacher and home maker groups. On the basis of the study the following tentative score was used: Running water in house 15 points, adequate sewage disposal 13, windows and doors screened 12, bath complete 10, electric or gas

lighting 9, central heating 9, power for heavy housework 9, telephone 8, at least one room for each member of the household 8, and ice box or mechanical refrigeration 7.

Some indices of urbanization in two Connecticut rural towns, C. D. CLARK (*Social Forces, 9 (1931), No. 3, pp. 409–418*).—Using data secured by Hypes (E. S. R., 59, p. 286), five indexes of urbanization were determined for the towns of Cheshire, representative of the areas of specialized farming in the central manufacturing region of Connecticut, and Killingworth, representative of the areas of decadent farming, as follows: Mobility, using a formula based on that of Markey (E. S. R., 63, p. 184); home equipment score, based on the method noted above; organizational membership; ratio of certain services obtained in urban centers to those supplied by local towns and in adjacent villages; and ratio of nonrural newspapers and magazines to farm publications.

The indexes for the areas were, respectively, for mobility 14.42 (standard deviation 7.6) and 13.93 (standard deviation 7.1), home equipment 65.38 (standard deviation 29.8) and 36.63 (standard deviation 25.8), number of organizations per family 2.48 (standard deviation 1.71) and 1.67 (standard deviation 1.54), ratio of urban services 2.34 and 0.43, and ratio of nonagricultural to farm publications 2.57 : 1 and 1.40 : 1.

Comparison of the indexes for foreign and native families and for commuters raised on farms and in cities showed that all the indexes except mobility were higher for native families and all but number of organizations per family for city-born commuters. Correlation of +0.552 and +0.446 were found between home equipment scores and total income, and +0.322 and +0.478 between home equipment scores and years of schooling of the head of the family.

Farm family participation in lodges, grange, farm bureau, Four-H clubs, school, and church, E. D. TETREAU (*Ohio State Univ., Dept. Rural Econ. Mimeogr. Bul. 29 (1930), pp. [1]+30*).—This study of 610 farm families in Madison and Union Counties, Ohio, was made in cooperation with the U. S. D. A. Bureau of Agricultural Economics. Tables are included and discussed showing by county, by tenure groups, and by three groups differentiating tenure distribution, the membership in lodges, the grange, the farm bureau, 4-H clubs, and churches, and the participation in the activities of such organizations and of schools.

Owners-in-prospect showed a superior degree of participation as compared with that of owners or tenants. In areas where tenants were considerably in the minority they competed closely with the other tenure groups. Where tenants were in the majority the degree of participation was relatively low for both tenants and owners.

Farm family equipment for communication and for household convenience, E. D. TETREAU (*Ohio State Univ., Dept. Rural Econ. Mimeogr. Bul. 30 (1931), pp. [1]+15*).—Tables are given showing for the 610 families referred to above, by the same grouping, the number of telephones, radios, musical instruments, and household conveniences of different kinds possessed, newspapers and periodicals taken, types of roads, and vacations, visits, trips, and outings. The study was made in cooperation with the U. S. D. A. Bureau of Agricultural Economics.

Young people's organizations in relation to rural life in Virginia, with special reference to 4-H clubs, W. E. GARNETT (*Virginia Sta. Bul. 274 (1930), pp. 87, figs. 25*).—This bulletin is the third of the rural organization series of studies of the station (E. S. R., 57, p. 787; 62, p. 185). The first section describes the aims, organization, and procedure of 4-H club work, analyzes the results obtained and factors and conditions affecting club work, and dis-

cusses the work in the light of approved educational principles and practices. The second section covers the place of club work in the educational system of the State, the provisions in the public school system for specialized rural life training, and the possibilities of promoting efficiency and economy through a closer coordination of 4-H club work and the public school system. Section 3 summarizes the strong points, valuable results, and weaknesses of the 4-H club program; the principles the observance of which is necessary for maximum efficiency in club work; the questions of educational policy involved in club work and the measures necessary for improvement of such work; and the strong and weakest points of the program of the vocational schools and affiliated groups and the measures necessary for improvement in such work.

A study of the effects of club work on school work by F. H. Stubbs (pp. 82–87) is also included. Ruch's method for constructing objective tests was followed rather closely, the following attitudes being chosen for study: Scientific mindedness (fair, open, scientific, critical mindedness); cooperation (leadership and followership); inventiveness and initiative; responsibility and reliability; interest in home and family; interest in school; interest in community; and interest in work or occupation. The attitude-information test was given by the county superintendent of schools of Orange County to sixth and seventh grade pupils in January and May, 1930. In determining the educational results of club work a comparison was made of the gains from the first to the second test of 83 pupils who were 4-H club members and 83 who were not club members. The critical ratios (difference divided by standard deviation) for the several attitudes were: Total, 17.11, in favor of the club group, interest in occupation 12.57, information or knowledge 2.6, responsibility and reliability 2.44, cooperation 2.28, interest in home and family 1.95, and interest in school 0.67. Those in favor of nonmembers were for initiative and creativeness 2.82, interest in community 2.27, and scientific mindedness 1.83. The conclusions are drawn that "(1) positive and significant values are contributed to the education of children by 4-H club work. (2) If an informal cooperation between the schools and clubs had produced significant results, a definite and purposeful program of integration of school and club work would result in greater educational values."

FOODS—HUMAN NUTRITION

Nutrition and food chemistry, B. S. Bronson (*New York: John Wiley & Sons; London: Chapman & Hall, 1930, pp. VIII+467, figs. 34*).—This volume has been written to serve as a college textbook on the chemistry of food and nutrition for students who have little foundation in physiology and none in organic chemistry. The first 12 chapters, comprising a little over half the volume, deal with the chemistry of digestion and absorption, the fate of the various foodstuffs in the body, protein and energy requirements, inorganic salts and acid-base balance, and vitamins. The remaining 6 chapters deal with the composition, manufacture, and food values of the principal groups of foods and food products.

New York State milk standards, terms used in the standardization of eggs, and tables on the distribution of vitamins and on the iron and copper content of foods are appended.

The subject matter throughout the entire volume is up to date, and the authoritativeness of the information presented is enhanced by numerous footnote references to original sources.

Chemistry and cookery, A. L. MacLeod and E. H. Nason (*New York and London: McGraw-Hill Book Co., 1930, pp. XII+545, figs. 25*).—This volume is the

outcome of the authors' experience in the development of an elementary chemistry course for college students of home economics. On the theory that "while the fundamentals of chemistry remain the same whether presented to home economics students, liberal arts students, or embryo engineers, the effective method of presentation will vary greatly with the different groups," cookery has been selected as the science to which to apply the principles of chemistry in their logical development. An even more radical departure from the customary elementary chemistry texts is the development and application of the electronic theory. In justification of this the authors state "in our own classrooms we have found that this theory gives to chemistry a concreteness and meaning which is lacking without it, and that its introduction at the beginning of the course results in a saving of time and effort which is incredible to the teacher who has used only the older method."

It is not until the latter part of the volume in the chapters on eggs and egg cookery, meat and meat cookery, and vegetable cookery that the main emphasis in the text itself is on the processes of cooking, but at the end of each chapter throughout the entire volume the connection is made with cookery and various household processes by means of appropriate questions.

Shrinkage of roast beef in relation to fat content and cooking temperature, L. M. ALEXANDER (*Jour. Home Econ., 22 (1930), No. 11, pp. 915–922, figs. 3*).—This contribution from the Bureaus of Home Economics and Animal Industry, U. S. D. A., consists of a compilation and discussion of data on the shrinkage of beef ribs of several degrees of fatness under different conditions of roasting in gas-heated ovens. The samples included 41 pairs and 6 single 9–10–11 rib roasts, 5 pairs of 6–7–8 rib roasts, and 8 single two-rib roasts. The roasting methods were based on those adopted for beef ribs in the national cooperative project on factors affecting the quality and palatability of meat. The shrinkage of each roast was determined as total, representing the difference between the weights before cooking and immediately after the roasts had been removed from the oven; drippings, or the weight of the mixture of fat and juice which cooks out of the meat and collects in the roasting pan; and evaporation, or difference between total and drippings losses. The losses were calculated as percentages of the weights of the uncooked roasts.

In studying the relation between the shrinkage of beef ribs during cooking and their estimated fat content, 30 pairs of 9–10–11 cuts covering a wide range of quality were used. The variations in fat content were estimated roughly from data contributed by the Bureaus of Animal Industry and Agricultural Economics relating carcass grade of beef to chemical fat content. Attention is called to probable discrepancies between the actual and the estimated fat content and to the probable wide variations in fat content of beef ribs within any one grade. All roasts were seared for 20 minutes at an average oven temperature of 262° C. Of each pair 1 was roasted at 125° until the temperature at the center of the meat reached 58° and the other at 178° until the center temperature was about 52°.

The relative losses of good, medium, common, and extremely thin roasts at the different temperatures were in agreement with the conclusions of Grindley, McCormack, and Porter (E. S. R., 13, p. 772) that fat loss is directly, and water loss inversely, related to the fat content of the meat. The choice roasts lost less in drippings than the good-grade roasts. It is suggested that these may have been lower in fat content than some of the good roasts. Reasonably good agreement was shown in the cooking losses of 9 check pairs of roasts.

In determining the effect of different oven temperatures on shrinkage of the meat, 25 pairs were used for the comparison. The data showed that shrinkage increased with increased oven temperature, and that drippings losses in-

creased proportionately more than evaporation losses. The more thoroughly the beef was cooked, the greater was its shrinkage. Although direct comparison between pairs of cuts cooked to the medium or well-done stage, respectively, was not possible, the evaporation losses of 3 two-rib roasts seared for 30 minutes at 249° and finished at 152° were obtained at rare (60°) and again at medium done (70°). The evaporation losses for the rare roasts were 6.2, 8.9, and 10.2 per cent, respectively, and for the medium 11.8, 14.2, and 15.2 per cent, respectively, of the uncooked cut.

In conclusion the author emphasizes the necessity of using pairs of cuts from the same carcass for comparing the effects of different cooking methods on shrinkage.

A study of the relative value of honey and sucrose in bread manufacture, W. F. Geddes and C. A. Winkler (*Canad. Jour. Research, 3 (1930), No. 6, pp. 543–559, figs. 3*).—The belief that the substitution of honey for sucrose in the manufacture of bread results in a more rapid rate of fermentation and in an improvement in the flavor and keeping quality of the bread was tested by substituting honey for commercial sucrose in various straight-dough bread baking formulas. The doughs were fermented for varying times, proofed, and baked in the usual manner and the loaves compared with others in which sucrose was used. No significant differences in loaf volume, flavor, or other bread characteristics could be detected. The baking studies were supplemented with determinations of the rate of gas production and also the residual reducing sugar content of the doughs at time intervals corresponding to those in the baking tests. Similar tests were made on partly buffered yeast-honey and yeast-sucrose suspensions of equivalent sugar concentration, but no difference was observed in the rate of gas production. Studies on the rate of inversion of sucrose by yeast showed that the rate of invertase action exceeded the speed of zymase action, thus indicating that sucrose inversion is not a limiting factor in the rate of gas production in bread doughs.

It was concluded that there is no basis in fact for the claim that honey possesses superiority over sucrose as a substrate for yeast, but that it is of equal value when compared on the basis of equivalent sugar content. The suggestion is made that the best means of extending the market for honey in the baking industry would seem to lie in the direction of increasing its use in sweet goods, such as various cookies, for which the higher sweetening power and the greater hygroscopicity would render it particularly valuable.

Manufacture and preservation of cranberry products, (*Massachusetts Sta. Bul. 271 (1931), p. 267*).—Further progress by C. R. Fellers, J. A. Clague, and W. W. Chenoweth on this project (E. S. R., 63, p. 590) is noted as follows:

Frozen cranberries held at 10° F. for from 1 to 12 months have been found as satisfactory as fresh fruit for sauce manufacture. As a result cranberries have been frozen on a large scale for manufacture into sauce during the off-season. Cranberry sauce itself is impaired by freezing, the jelly strength being greatly decreased and syneresis increased.

Preliminary studies on the vitamin C content of cranberries have indicated that the raw fruit and juice contain substantial amounts of this vitamin, 3 cc. of juice daily protecting guinea pigs against scurvy for 90 days, but that the commercial methods of sauce manufacture destroy the vitamin almost completely.

Utilization of frozen fruits in ice cream (*Massachusetts Sta. Bul. 271 (1931), p. 268*).—In the continuation by C. R. Fellers and M. J. Mack of this study (E. S. R., 63, p. 591), the fruits were packed with sugar sirups of varying concentration in place of solid sugar as previously. Oxidation, discoloration, and mushiness were largely obviated by the use of 40 to 60 per cent sugar

sirups, the products in general being superior to those packed with dry sugar. Invert sugar sirups gave no better results than sucrose, and corn sugar was distinctly unsatisfactory. Berries and cherries frozen with solid sugar and with sirup in gallon cans under vacuum gave the best quality of fruit.

The basal metabolism of Indians (Bengalis), H. N. MUKHERJEE and P. C. GUPTA (*Indian Jour. Med. Research, 18 (1931), No. 3, pp. 807–812*).—Basal metabolism measurements with the Douglas bag and the Haldane gas analysis apparatus are reported for 18 normal male Bengali in Calcutta. The values ranged from −0.3 to −31.2 per cent in terms of the Aub-Dubois standards, with an average of −13.3 per cent. The vital capacity and pulse pressure were also low. It is thought that the low basal metabolism may be due both to climatic and to nutritional causes.

Metabolic studies during pregnancy and menstruation, I. SANDIFORD, T. WHEELER, and W. M. BOOTHBY (*Amer. Jour. Physiol., 96 (1931), No. 1, pp. 191–202, figs. 4*).—The woman who served as subject of an earlier study of basal metabolism before, during, and after pregnancy (E. S. R., 54, p. 88) again served as subject in a similar study 2.5 years later.

The metabolism data obtained corroborated the conclusion of the earlier study that the gradual increase in total heat production during pregnancy can be accounted for by the added metabolism of the fetus, placenta, and accessory structures.

For periods of approximately 10 days each during the fourth, fifth, seventh, eighth, and tenth months of pregnancy and immediately after delivery the subject was on a weighed diet, daily collections were made of the urine, and near the end of each period an analysis of the blood was made. After the nineteenth week of pregnancy on an adequate nitrogen intake, there was a gradually increasing positive nitrogen balance, varying between 0.5 and 1.1 gm. daily. There was a slight decrease in the percentage of total nitrogen eliminated in the urine as urea, a slight increase in uric acid and amino acid nitrogen eliminated, an increase in creatine elimination, no change in creatinine until the ninth month when there was a sudden decrease, a slight increase in ammonia nitrogen, and no significant changes in the inorganic substances eliminated.

In addition to the observations made during the two periods of pregnancy, 336 basal metabolism determinations were made on this subject from February, 1923, to December, 1929, or between the ages of 34 and 41 years. The mean value of these determinations was 33.1±0.06 calories per square meter per hour.

Diet in relation to reproduction and lactation, III, P. D. WILKINSON and V. E. NELSON (*Amer. Jour. Physiol., 96 (1931), No. 1, pp. 139–145*).—This continuation of the series of studies previously noted (E. S. R., 56, p. 65) has been noted essentially from a preliminary report (E. S. R., 64, p. 585).

The relation of diet to health and growth of children in institutions, M. S. ROSE and C. E. GRAY (*Columbia Univ., Teachers Col., Child Devlpmt. Monog. No. 2 (1930), pp. VII+128*).—The main purpose of the dietary surveys of four child-caring institutions reported in this monograph was to determine whether or not the study of a dietary by food groups would be a valuable aid in judging quality and adequacy of the dietary. Since in institutions such as the ones selected children remain for a number of years, the physical progress of the children, especially growth in height and weight, could be followed for a relatively long time and correlated with the analysis of the dietaries.

A series of model dietaries, based upon the best knowledge of child requirements, was first prepared for children from 5 to 16 years of age, and these

dietaries were analyzed to find out what percentages of their total calories came from (1) cereal grains, (2) milk, (3) vegetables and fruits, (4) fats and oils, (5) sugars and sweets, and (6) eggs, cheese, meat, and other flesh foods. From these analyses standards were developed for the distribution of calories for children of different age groups from 5 to 12 and for different calorie requirements for children from the age of 13 to 16 years.

Of the institutions in which the studies were made, one was distinctly rural, two distinctly urban, and one suburban in location. With one exception the studies extended over a year, during which time dietary records were obtained, chiefly from the food purchased, and the physical progress of the children was followed by systematic height and weight records.

The results of these comparisons showed that there were fewest children graded poor as to height and weight in the institution where the diet was on the whole liberal in quantity and excellent in quality, and that there were the greatest number of children of short stature in the two institutions which had the poorest dietaries. It was concluded that the method selected does reveal probable defects in the diet, since each group makes certain typical contributions. "If the fats are too low there will in all probability be a deficiency in total calories. If the milk is too low there will be a deficiency of calcium unless cheese is used in unusually large amounts to take the place of milk. To have at least 25 per cent of the calories from milk means not only liberal calcium but also an adequacy of vitamin A. If milk is low and little fat containing vitamin A is used, there is danger of serious deficiency in vitamin A. If the fruits and vegetables are too low, the most obvious defect is likely to be in iron, but there is also probability of an insufficient supply of vitamins B and G for optimal health and growth."

The value of the monograph as a guide in the planning of dietaries for similar institutions is enhanced by a sample 3 weeks' menu based upon the standards proposed. In the preparation of this the authors had the cooperation of K. L. Foster.

An appendix contains the tabulated data of the dietary studies.

Diseases produced and prevented by certain food constituents, E. Mellanby (*Jour. Amer. Med. Assoc., 96 (1931), No. 5, pp. 325–331, figs. 4*).—The subject matter of this paper, which is abbreviated from one read before the section on diseases of children at the 1930 meeting of the American Medical Association, is essentially the same as that noted from another source (E. S. R., 63, p. 594).

Mottled enamel in a segregated population, G. A. Kempf and F. S. McKay (*Pub. Health Rpts. [U. S.], 45 (1930), No. 48, pp. 2923–2940, pls. 3*).—Following a general description of the dental defect known as mottled enamel (a condition characterized by an opaque whiteness of the enamel or by brown, yellow, or black stains), a report is given of a survey of this condition in the mining town of Bauxite, Ark. Evidence collected during the examination of all of the school children in the town showed that the defect appeared in the community subsequent to the change in water supply from shallow surface wells and a few springs to deep driven wells. No cases of the defect were found in individuals whose tooth enamel had developed somewhere else or in those who lived beyond the district supplied by this water. The defect was entirely absent among children in a neighboring town which obtained its drinking water from a river. Analyses of the deep well water and of water in other communities where the defect is prevalent furnished no clue as to the causative agent.

An extensive bibliography is appended.

***The effects of vitamin deficiency upon the coefficients of digestibility of* protein, fat, and carbohydrate,** R. R. St. Julian and V. G. Heller (*Jour. Biol. Chem., 90 (1931), No. 1, pp. 99–110*).—This is a complete report, with experimental data, of an investigation, the conclusions of which have been noted from another source (E. S. R., 64, p. 790).

The vitamin A content of oats, C. R. Meyer and R. A. Hetler (*Jour. Agr. Research [U. S.], 42 (1931), No. 8, pp. 501–506, figs. 2*).—This contribution from the Illinois Experiment Station constitutes the complete report, with experimental data, of an investigation, the general results of which have been noted previously from another source (E. S. R., 60, p. 294; 62, p. 391). A variety of naked oats (Illinois Hull-less) was used exclusively. This was fed to rats as the whole oats and as oat oil, prepared by cold acetone extraction essentially as described by Sure (E. S. R., 57, p. 896). The curative method, as described previously (E. S. R., 62, p. 492), was used throughout.

Ophthalmia was not cured and death occurred when the whole oats was fed at levels of 10, 30, or 60 per cent of the diet, or from 0.6 to 5 gm. daily. When oat oil was fed at levels as high as 30 and 50 per cent of the diet, or in amounts of 1.6 gm. daily (equivalent to 43 gm. of the whole oats), a slight improvement in the eye condition was noted, although the ophthalmia was never cured completely. Prompt cure of the ophthalmia and resumption of growth when cod-liver oil was added to the diet in which oat oil had furnished the sole source of vitamin A demonstrated the absence in the oil of a toxic factor.

The results indicate that whole oats are of no value and oat oil of little practical value as a source of vitamin A.

Vitamins A and D in fish oils, E. M. Nelson and J. R. Manning (*Indus. and Engin. Chem., 22 (1930), No. 12, pp. 1361–1363, figs. 2*).—Tests for vitamin A and vitamin D in samples of various commercial fish oils are reported, with the conclusion that the samples of sardine, Alaska herring, and tuna oils tested were about one-tenth as potent as cod-liver oil in vitamin A. Maine herring oil contained about one-half as much vitamin A as Alaska herring oil, and menhaden oil no demonstrable amounts. The salmon oil tested had about one-third the vitamin A potency of the cod-liver oil used for comparison.

In the vitamin D tests, in which the McCollum line test as modified by Steenbock and Black was used, the relative values of the different oils on the basis of cod-liver oil as 100 were tuna 125, sardine 100, menhaden 75, salmon 50, Alaska herring 30, and Maine herring 15.

These results are considered of commercial importance as suggesting a potential domestic source of vitamin-bearing fish oils, particularly for animal feeding.

***Further evidence of the complex nature of vitamin B.—II, Evidence that* a third factor exists,** C. H. Hunt and W. Wilder (*Jour. Biol. Chem., 90 (1931), No. 1, pp. 279–291, figs. 8*).—This paper, continuing the series noted previously (E. S. R., 60, p. 690), contains the experimental data and discussion upon which are based the conclusions noted from another source (E. S. R., 64, p. 694).

A study of the vitamin B complex of yellow yautia (Xanthosoma sagittaefolium) and of plantain (Musa paradisiaca L), J. H. Axtmayer (*Porto Rico Jour. Pub. Health and Trop. Med., 6 (1930), No. 2, pp. 229–232, pl. 1*).—Following the same technic as in a previous study of the vitamin B complex (vitamins B and G) in a mixture of red kidney beans and polished rice (E. S. R., 63, p. 895), the author has demonstrated that vitamin B (B_1) is the first limiting factor of the vitamin B complex in yellow yautia and vitamin G (B_2) in the plantain. In the combination of these two foods, as used

in many native Porto Rican dishes, the deficiency of one is thus compensated by the other.

Human milk studies.—VI, Vitamin potency as influenced by supplementing the maternal diet with yeast, S. S. McCosh, I. G. Macy, and H. A. Hunscher (*Jour. Biol. Chem., 90 (1931), No. 1, pp. 1–13, figs. 7*).—In this continuation of the series of studies noted previously (E. S. R., 59, p. 690), the breast milks from the three women serving as subjects in the study of the metabolism of women during the reproductive cycle (E. S. R., 63, p. 488) were tested for their vitamin B content (old nomenclature) before and after the diets of the women had been supplemented by 10 gm. of yeast daily. The preexperimental period, during which the milk was tested before the addition of yeast to the diet, extended from the sixth week to the sixth month, and the experimental period from the sixth to the tenth month of lactation. A month was allowed to elapse after the yeast addition had been made before the milk was again tested.

Each milk was fed at levels of 16, 20, and 25 cc. daily. At all these levels variations in the concentration of vitamin B in the milk from the different subjects were evident, and it was found that the concentration of the vitamin varied inversely with the quantity of milk secreted. "These findings may indicate either a dilution phenomenon or a greater demand for vitamin B in the actual physiological protoplasmatic processes involved in the elaboration of large quantities of milk."

The average caloric intake per square meter of surface area of the rats on each level of milk from each of the three women was greater during the preexperimental than the experimental period. This is thought to indicate that some substance other than the antineuritic vitamin is carried over into the milk from the maternal diet when supplemented with yeast that is responsible for a more economical and effective use of the food material for growth.

At the end of six weeks of the experimental period, 0.4 gm. daily of autoclaved yeast was added to the diet of the experimental animals. In most cases the rats responded with increases in growth rate, suggesting that the milk was deficient in vitamin G.

Sterol content and antirachitic activatibility of mold mycelia, L. M. Pruess, W. H. Peterson, H. Steenbock, and E. B. Fred (*Jour. Biol. Chem., 90 (1931), No. 1, pp. 369–384*).—This paper reports the growth and sterol production of a number of molds under various conditions and the antirachitic activatibility of 12 of the molds showing good growth and of 5 varieties of mushrooms grown in the open. Eight of the molds and 3 of the mushrooms brought about distinct healing of rickets when fed at a level of 10 mg. of the irradiated material per rat per day for a period of 7 days. The varieties of mushrooms showing this action on irradiation were *Marasmius oreades*, *Hypholoma incertum*, and *Secotium acuminatum*.

Osteomalacia (late rickets) studies.—V, Osteomalacia in the Kangra District. VI, Factors in treatment. VII, Rickets among Indian children of school age. VIII, Adult spasmophilia. IX, Distribution, D. C. Wilson (*Indian Jour. Med. Research, 18 (1931), No. 3, pp. 951–958, 959–962, 963–968, 969–974, 975–978*).—The five papers listed report a continuation of the previously noted investigation (E. S. R., 63, p. 195) of osteomalacia in India, conducted under the auspices of the Indian Research Fund Association. Part 6 is by the author and W. K. Coombes.

Comparative studies on the antirachitic action on rats of milk irradiated by the Scholl and Hoffmann methods [trans. title], W. Schempflug (*Milchw.*

Forsch., 10 (1930), No. 5–6, pp. 455–480, figs. 15).—This investigation was undertaken on account of the fact that milk irradiated by both methods was on the market in Vienna with claims for antirachitic properties. In the Scholl apparatus the milk is irradiated in an atmosphere of carbon dioxide or nitrogen. The time of exposure to the rays is for 1 to 1.2 seconds, and by a system of water-cooling the temperature of the milk is not increased more than a degree or two. In the Hoffmann system the milk is irradiated in a thin film without special precaution to exclude air. Both forms of apparatus are described and illustrated.

As tested on rachitic rats, the milk irradiated by the Hoffmann method had no higher rachitic potency than nonirradiated milk, while the milk irradiated by the Scholl system cured rickets when fed in amounts in some cases as small as 0.03 cm. daily.

The effect upon milk of a vitamin D treated feed [trans. title], ROEMMELE and STÖHR (*Milchw. Forsch., 10 (1930), No. 5–6, pp. 413–423*).—A corn meal mixture containing 10 cc. of an oil solution of vitamin D per kilogram was fed for 6 weeks to dairy cows in amounts of 100 and 1,000 gm. per animal per day, and its effect upon the composition of the milk was determined by comparisons with milk from other cows in the same state of lactation and on the same feed without vitamin D. The vitamin D solution was said to be of the most satisfactory concentration for animal feeding. No significant differences could be detected in the content of vitamin D, fat, and calcium in the milk, or in the volume of the milk and the melting point of the milk fat.

MISCELLANEOUS

The Forty-third Annual Report of the Colorado Agricultural Experiment Station for the short period 1930, C. P. GILLETTE ET AL. (*Colorado Sta. Rpt. 1930, pp. 44*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1930, a report of the director on the work of station for the 7-month period from December 1, 1929, to June 30, 1930, and departmental reports.

Annual Report of the Massachusetts Agricultural Experiment Station, 1930, F. J. SIEVERS ET AL. (*Massachusetts Sta. Bul. 271 (1931), pp. 227–289*).—This contains the organization list, an introduction by the director, and departmental reports. The experimental work not previously noted is for the most part abstracted elsewhere in this issue.

NOTES

Pennsylvania College.—An unemployment relief building fund appropriation of $900,000 has been granted by the legislature. This appropriation was made immediately available and will be used for a dairy husbandry building to cost $500,000 and a home economics unit to cost $400,000. The latter building will be a three-story brick structure and will accomodate all departments of home economics except home management, which will continue in its present practice house. A cafeteria, a nursery school, clothing and food laboratories, and a library and reading room are among the facilities which will be provided.

New Haven Meeting of the Agricultural Libraries Section.—The meeting on June 22 of this section of the American Library Association centered around the topic of the relationships between the U. S. D. A. libraries and those of the land-grant colleges, universities, and experiment stations. Discussion of this important theme had been begun at the Washington meeting of 1929, when, as already noted in these columns (E. S. R., 61, p. 102), a committee on relationships, headed by Charles A. Brown of the Iowa College, was appointed to study the subject in greater detail. Early in 1931 this committee prepared and circulated among the librarians of the group a questionnaire of 11 items, and the results of this inquiry were here presented.

Most of the queries which were made dealt with bibliographical details of restricted interest, but on others the replies were of wider significance. Participation by a librarian in the program of the Association of Land-Grant Colleges and Universities at its convention in Chicago from November 16 to 18, 1931, was requested with a view to acquainting that body with prevailing conditions and problems. An inadequacy of personnel was revealed as an obstacle to the undertaking of various forms of bibliographical assistance. Indorsement was given to a suggestion for a compilation by the Department Library with the cooperation of the several State institutions of a list of the theses presented for advance degrees in agriculture and home economics. but some diversity of opinion developed as to the necessity of a proposed system of printed cards of experiment station publications. A proposed study by the Office of Experiment Stations as to the extent to which the needs of experiment station workers are being met by existing library facilities was favored by a majority of those reporting. This study, if undertaken, would be an extension of one phase of the recent land-grant college survey, but more thoroughgoing and comprehensive in its reports of the findings at the various institutions.

The committee on cooperative bibliographical aid reported that nine lists had been compiled for publication in *Rural America*, as well as an index to the sources of the official and unofficial agricultural statistics of California. Caroline B. Sherman of the U. S. D. A. Bureau of Agricultural Economics was added to the membership of this committee, and the place of Bess Lowry, Iowa State College, who asked to be relieved, was assigned to Cora L. Feldkamp of the Office of Experiment Stations Library. The officers chosen for the coming year are Elsie D. Hands of the Oklahoma College as chairman and Jessie M. Allen, U. S. D. A. Bureau of Plant Industry Library, secretary.

An interesting supplement to the meeting of this section was a visit to the Connecticut State Station under the guidance of Director W. L. Slate. This visit provided opportunity for a survey of the working conditions and distinctive problems at an experiment station separated from the usual college environment.

EXPERIMENT STATION RECORD

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EDITORIAL

THE QUARTER CENTENNIAL OF THE AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS

The year 1931 may well be remembered by agricultural engineers as a time of unusual interest. On July 1, a Bureau of Agricultural Engineering was established in the United States Department of Agriculture, replacing the former division of agricultural engineering of the Bureau of Public Roads and thereby affording more adequate recognition of this relatively new field of activity. A few weeks earlier the honorary degree of doctor of engineering was conferred by the University of Nebraska upon an alumnus widely known as a pioneer worker, Prof. J. B. Davidson, head of the department of agricultural engineering at the Iowa State College. The year was also noteworthy for two significant anniversaries, the centennial of the invention of the reaper by Cyrus Hall McCormick and the quarter centennial of the founding of the American Society of Agricultural Engineers.

By a somewhat unusual series of coincidences, these four events were more or less interwoven in the summer's chronicle of events, and each had its bearing on the society's convention program. The convention itself was held at the Iowa College from June 22 to 25, and Dr. Davidson, an early advocate of the society and its first president, took a prominent part in its proceedings. In an address he outlined the philosophy of agricultural engineering and showed mathematically how it is related to cost of production and net profit, and he organized and presented an elaborate pageant portraying the evolution of grain harvesting methods and equipment. The dramatic aspects of the gathering were further heightened by the presence of Mr. Cyrus Hall McCormick, jr., a grandson of the great inventor. Mr. McCormick also addressed the convention, reviewing the century's progress in the development of farm machinery and indicating the economic and humanitarian benefits derived therefrom. While insisting that great inventors are born and not made, he pointed out that the ultimate development of their ideas into practical cost and labor saving machines is usually the result of painstaking research and tireless testing by men trained in science and its practice.

Presumably as a means of encouragement of such services, a gift of $10,000 had been made to the society by members of the McCormick family, and this gift was formally accepted for use in the

recognition of unusually meritorious work in agricultural engineering. A portion of the gift is to be expended for a design and die for a gold medal to be known as the Cyrus Hall McCormick Medal and presented annually to some member of the society for outstanding achievement, while the income from the remainder of the fund will be used for the medal itself and a cash award. The first award will be made in 1932.

The address of the president of the society, Mr. R. W. Trullinger of the Office of Experiment Stations, stressed the importance of cooperation between the manufacturing industries and agricultural engineers in public service research. Serving the needs of the farmer with small or medium acreage, as well as those of the large scale corporation farm, also was emphasized as sound economics for the country as a whole. The need for accelerating the progress of research, extension, and teaching in agricultural engineering was pointed out, and special emphasis was placed on the importance of more advanced study for research workers in the subject. In reviewing the history of the society during its first quarter century, Mr. Trullinger pointed out that it had grown from a small group of college professors to a body of more than eight hundred engineers engaged in both public and private pursuits, some of them activities of international scope. It is now systematically organized into technical and other divisions and committees and highly coordinated with similar agricultural groups. With this organization it has fostered research and extension by both public and private agencies which have done much to curtail the time and labor required in the performance of the major farming operations, thereby reducing the cost of production, improving the quality of farm products, and removing a large part of the drudgery from farming. Thus it has helped to secure higher standards of living on farms, and to lay the foundations for an improved type of civilization in many rural communities.

A similar inspiring ideal of service was suggested by Hon. L. J. Dickinson, United States Senator from Iowa, who, using the Iowa farm as a background, discussed the fitting of engineering into the agricultural picture. Drawing also upon his long experience on the Subcommittee on Agriculture of the U. S. House of Representatives, he enumerated the thought processes which must go into the organization of public service research agencies whose purpose is to introduce efficiency and economy into the industry of agriculture and improve the farm as a home as well as a means of livelihood. Senator Dickinson pointed out that engineering should work to make agriculture self-sustaining if necessary and, in any event, into an industry as independent as other industries. Thus the plans of public service research and other agencies should be organized to meet the real needs of the actual farming conditions of a region, and

the success of the procedure in rural areas of Iowa was cited to support this contention.

In connection with the organization of research in agricultural engineering an important address was given by Dr. Andrew Boss, vice director of the Minnesota Station. Dr. Boss pointed out that in the last analysis the research worker is the controlling factor in the success of research, and it is therefore of primary importance to broaden the vision of such workers by training them along lines collateral to their subject as well as in the sciences pertaining strictly thereto. He emphasized in this connection that while agricultural engineers should be primarily well versed in engineering principles, they also should be familiar with agricultural science and economics and with agricultural history if their research is to reach a maximum of productiveness.

The function of the extension engineer in the reorganization of American agriculture was discussed by Prof. B. B. Robb of Cornell University. Striking an economic keynote, Prof. Robb portrayed the reorganization of American agriculture during and since the World War, and showed what an important part the extension agricultural engineer has had in maintaining economic soundness in much of the agriculture of the country.

In a closely related vein Dr. E. A. White, director of the National Committee on the Relation of Electricity to Agriculture, spoke on electricity and the agriculture of the next 10 years. Adhering strictly to the principle of serving the farm as a family home, Dr. White stressed the importance of so developing the agricultural uses of electricity as to build a more stable farm population. The purpose should be to provide the family size farm with a peculiarly adaptable form of power for stationary operations and thereby give that farm another means of competing with larger units on the basis of a reduced labor requirement and an increased output per worker.

Another address of considerable general interest was that presented by Dr. O. R. Sweeney, head of the chemical engineering department of Iowa State College, which dealt with the probable future development of chemistry in agriculture. Dr. Sweeney described the experimental processes by which cornstalks and other farm wastes are transformed into hundreds of useful materials, including lumber, insulating material and the like, and conducted a series of demonstrations in the experimental laboratory.

The usual sessions of a technical character were held during the convention by the five divisions of college work, land reclamation, power and machinery, structures, and rural electricity. Prominent among these was the college division session, which was presided over by Mr. S. P. Lyle of the U. S. D. A. Bureau of Agricultural

Engineering, and focused its attention primarily on the problems of agricultural engineering education. Prof. C. E. Seitz of the Virginia Polytechnic Institute presented the recommendations of the division for agricultural engineering curricula, while Prof. H. B. Walker of the California University and Station and Mr. L. W. Wallace, executive secretary of the American Engineering Council, addressed the session on engineering educational standards. The latter insisted that the organized profession itself should take an active interest in improving engineering education and should exert a direct influence on professional standards through selective care in election to its membership. He also pointed out that the present day service of engineers requires considerable education along cultural as well as technical lines.

The program of the land reclamation division was built primarily upon a foundation of committee reports, with Dr. Elwood Mead, U. S. Commissioner of Reclamation and an honorary member of the society, as the principal speaker. In an address on the Hoover Dam, Dr. Mead reviewed the history of the Southwest which led to the undertaking of this project, discussed its significance from the standpoints of flood control, water supply, and power generation, and summarized the progress being made.

The power and machinery division presented a number of outstanding papers and reports. Prof. M. L. Nichols summarized the results of nine years of research at the Alabama Experiment Station on friction, adhesion, and wearing resistance of metals in soils to provide basic principles for the design of tillage implements. Prof. R. U. Blasingame reported the progress of studies at the Pennsylvania Station in the development of the potato harvester, and Prof. C. C. Johnson discussed the development at the Washington Station of machinery for weed control. Notable among the numerous technical committee reports were those on corn borer control, soil dynamics, and fuels and lubricants for tractor engines.

Problems of dairy farm structures, the farm home, and a research program in farm structures were featured by the structures division, presided over by Prof. F. C. Fenton of the Kansas College and Station. A special feature of this program was a symposium on the place of the agricultural engineer in farm home improvement. Mr. M. A. R. Kelley of the U. S. D. A. Bureau of Agricultural Engineering reported the progress of studies on the influences of temperature changes on milk production, and Mr. J. D. Long cited experience at the California Station with the walk-through type of dairy barn. Especially interesting from the research point of view were papers reporting studies of wind loads on the gambrel roof barn by Mr. H. N. Stapleton of the Kansas Station and on wind losses to Iowa farm buildings by Mr. M. F. Schweers of the Iowa

Station. In the former case wind tunnel experiments and analytical studies of wind stress distribution were reported which revealed facts of considerable importance in roof design.

At the business session the presidency of the association for the ensuing year was bestowed upon Mr. L. J. Fletcher, formerly of the California Station. Profs. R. U. Blasingame and H. Giese, respectively, of the Pennsylvania and Iowa Colleges and Stations were elected vice presidents, with Mr. Raymond Olney continuing as secretary-treasurer.

The attendance of members and visitors exceeded all previous records. The various sections of this country were well represented, and an international note of felicitation and good will was sounded by Dr. C. H. T. Dencker, vice president of the German Society of Agricultural Engineers and director of the department of agricultural engineering of the Prussian Agricultural Research Institute. Dr. Dencker briefly described some of the activities of the institute and invited the cooperation of similar American institutions.

The interest of the society itself in international relationships was tangibly expressed in a unanimous decision to sponsor an international agricultural engineering congress in 1933. If this project is carried to fruition, it will be the first gathering of the sort on American soil, and likewise the first anywhere in which this country has actively participated. The decision to undertake this responsibility comes as a fitting climax to a quarter century of impressive domestic development, and presages the beginning of another era of even greater usefulness.

A BRIEF HISTORY OF THE SOUTH CAROLINA EXPERIMENT STATION

Another useful contribution to the history of the experiment station movement has recently appeared as a circular of the South Carolina Station. This circular was prepared by Mr. G. H. Aull, assistant director of the station, and as its title indicates deals somewhat briefly with the beginnings and development of experiment station work in agriculture in the State of South Carolina.

Mr. Aull traces the beginning of such work to the establishment of a testing garden by the Lords Proprietors on Ashley River in 1669–70, quoting from Carrier in The Beginnings of Agriculture in America as indicating that this enterprise was "the first agricultural experimental farm ever established in America for the purpose of improving agriculture." The distinctive purpose in view in this work was to learn, under the pioneer conditions prevailing, "the soil to which each species of plants was best adapted and the season of the year most favorable for planting."

Reference is also made to the activities of the Agricultural Society of South Carolina, founded in 1785 for "promoting and improving

agriculture and other rural concerns." This society early evinced an interest in experimental work, and about 1806 realized approximately $10,000 from a lottery to pay for its farm on Charleston Neck and to "put in full force" its intention of "prosecuting experiments on the same, conducive to agriculture, horticulture, and botany." While accomplishment from this undertaking was not great, it appears that experiments were carried on with jute, small grains, grasses, and tea.

The establishment of the experiment station itself, however, is associated with a much later period. In December, 1886, nearly three months before the passage of the Hatch Act, the general assembly appropriated $10,000 for the establishment of two experimental farms to be known as the South Carolina Experimental Stations. These farms were organized in July, 1887, at Spartanburg in the Piedmont region and at Darlington near the coast. Upon the acceptance by the State of the Hatch Act six months later, a third station was provided at Columbia under the supervision of the board of trustees of the University of South Carolina, at which institution experiments had already been carried on since 1882 under the direction of Dr. R. H. Loughridge. In March, 1888, the three stations were consolidated under the same direction and management, with an annual income of $20,000 per year, of which $5,000 was supplied by the State Department of Agriculture. President J. M. McBryde of the university was designated as director, with the active management devolving upon Prof. Milton Whitney as vice director.

Meanwhile, by the will of Hon. Thomas G. Clemson, superintendent of agricultural affairs in the U. S. Department of the Interior from 1859 to 1861 and actively interested in the promotion of agricultural education, the State had been bequeathed the old homestead of Hon. John C. Calhoun at Fort Hill and certain other property and had established thereon in 1889 the Clemson Agricultural College of South Carolina. Additional legislation provided that in November, 1890, the real estate and other property of the experiment station in Columbia and the experimental farms in Darlington and Spartanburg should be sold and the proceeds devoted to the establishment in their stead of the present station at Clemson College.

This somewhat obscure chapter of station history is revealed in considerable detail by Mr. Aull. Comparatively speaking, much less space is given to the subsequent development of the station, though a clear account is presented of the opening of its three substations. As a whole, considerable of interest is assembled in convenient and attractive form, and it seems evident that the announced purpose of the circular, to "give to the people of South Carolina a clearer vision, a more sympathetic understanding, and a deeper feeling of interest in their own experiment station," has been achieved.

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

Fruit jellies.—VII, The rôle of pectin.—3, Effect of temperature upon the extraction of pectin, P. B. MYERS and G. L. BAKER (*Delaware Sta. Bul. 168 (1931), pp. 46, figs. 15*).—This bulletin continues the researches on pectins (E. S. R., 61, p. 610), giving details of further experimental procedure and presenting numerous observations, including the following:

The extraction period being constant, the yield of pectin from albedo increased with increasing H-ion concentration to a maximum and then decreased with further increase in H-ion concentration, and with increasing extraction temperature the H-ion concentration necessary to maximum yield decreased. Further, "as the extraction temperature increases the yield of pectin increases when the extraction period is maintained constant. It is therefore impossible to obtain as great a yield at any definite temperature as may be obtained, under optimum conditions, at a higher temperature. When the H-ion concentration of the extracting medium is less than pH 3.0, no appreciable amount of pectin is liberated from the protopectin at temperatures below 60° C. when the extraction period is maintained constant at 30 minutes. Appreciable amounts of protopectin may be hydrolyzed even at room temperature in 30 minutes if the H-ion concentration of the extracting medium is sufficiently high. The jelly grade of a pectin increases to an optimum value as the H-ion concentration of the extracting medium is increased and then decreases as the H-ion concentration is still further increased, other conditions remaining constant regardless of the temperature of the extraction.

"The rate at which the jelly grade of a pectin decreases with increase in the H-ion concentration of the extracting medium, beyond the value necessary to produce the optimum jelly grade, varies with the extraction temperature; the higher the temperature the more rapid the rate of decrease in jelly grade. As the temperature of the extraction increases, the jelly grade of the resulting pectin decreases when the extraction period is maintained constant. As the temperature is increased from 40° to a temperature somewhere between 60 and 70°, there is but a slight reduction in the jelly grade of the pectin. As the temperature is increased from this point to 100°, the reduction in the jelly grade is very rapid. The jelly units increase to an optimum value as the H-ion concentration of the extracting medium increases and then decreases, other conditions remaining constant regardless of the temperature of the extraction. The jelly units, obtained under optimum conditions, increase as the extraction temperature increases, reaching an optimum value at approximately 78° when the extraction period is 30 minutes. As the temperature of the extraction is increased from 78 to 100°, the jelly units decrease rapidly. When the H-ion concentration of the extracting medium at any temperature is maintained constant at a pH insufficient to produce the optimum yield when the extraction period is maintained constant, the yield of pectin will increase to that optimum value as the extraction period is increased and then remain practically constant."

The interpretation placed upon the observations above recorded "leads to the conclusion that protopectin is not a simple compound of pectin and cellulose . . . or of pectin and an araban . . ., but is a much more complex sub-

stance which exists in fruits in various stages of hydrolysis. The insoluble pectic constituent of fruits then consists of a mixture of substances which vary in complexity, each one requiring a different temperature for its hydrolysis, the more complex the substance the higher the temperature required for its hydrolysis.

"When the H ion concentration of the extracting medium is maintained constant, the jelly grade of the pectin may actually be improved at temperatures of 80° and below by increasing the extraction period. Within this range of temperature the jelly grade increases to an optimum value and then decreases as the extraction period increases, the rate of decrease varying directly with the temperature of the extraction. The time necessary to reach the optimum jelly grade decreases as the temperature increases. At 100° the jelly grade at first decreases gradually as the extraction period increases and then decreases very rapidly. The jelly grade of the pectin increases rapidly as the extraction temperature decreases (H-ion concentration maintained constant) to some point between 60 and 70°. As the temperature decreases from this point the increase in jelly grade is more gradual. At temperatures of 80 and 100° the jelly units increase sharply to an optimum value and then rapidly decrease as the extraction period increases, other conditions maintained constant. At 60° under the same conditions the jelly units increase gradually to an optimum value and then gradually decrease so that after the first 140 minutes of the extraction the optimum jelly units are obtained. The extraction period may be prolonged an additional 95 minutes without any appreciable drop in jelly units. When the extraction temperature is 40° the jelly units increase gradually, reaching an optimum value in approximately 10 hours. The optimum jelly units obtainable at various temperatures increase to an optimum value and then decrease as the extraction period is increased, other conditions maintained constant. A larger number of jelly units may be obtained at 70° than at any other temperature. The conditions necessary to produce the optimum jelly units at 70° are: H-ion concentration of extracting medium—pH 1.45; extraction period—1 hour. The jellying substance extracted from a pectic material is a mixture of pectins varying in jellying power."

Some properties of honey colloids and the removal of colloids from honey with bentonite, R. E. Lothrop and H. S. Paine (*Indus. and Engin. Chem., 23 (1931), No. 3, pp. 328–332, figs. 3*).—"Cataphoresis measurements showed that the colloidal particles of most honeys are positively charged and that the charge can be reversed by increasing the pH of the solution. An isoelectric point is reached when the particles show no charge, and at this point maximum flocculation of colloidal material takes place. Determinations of the isoelectric point of several honey samples gave very nearly the same value, namely, pH 4.3. Above a pH of 4.3 the colloidal particles are negatively charged; below 4.3 they are positively charged.

"Flocculation of honey colloids can be brought about by the addition of appropriate quantities of bentonite, a colloidal clay whose particles are negatively charged. The action is one of mutual flocculation of oppositely charged colloids, and results in a brilliantly clear honey which is lighter than the original in color. This process promises to be valuable as a means of improving the quality and marketability of low-grade honeys."

Some organic acids in honey, E. K. Nelson and H. H. Mottern (*Indus. and Engin. Chem., 23 (1931), No. 3, pp. 335, 336*).—The volatile and nonvolatile acids in 15 samples of honey were determined.

"The total volatile acids range from 0.011 to 0.051 per cent, and consist mainly of a mixture of formic acid and acetic acids. Sage honey has the largest amount of acetic acid (0.046 per cent), and tulip honey has the largest

amount of formic acid (0.024 per cent). Citric acid accompanied by malic acid was found in all samples. Succinic acid was identified in the samples of higher acidity (sourwood, cotton, and tulip)."

Free water necessary to change beta anhydrous lactose to alpha hydrous lactose, R. W. BELL (*Indus. and Engin. Chem.*, *22* (*1930*), *No. 4*, *pp. 379*, *380*, *fig. 1*).—The author of this contribution from the U. S. D. A. Bureau of Dairy Industry finds the continued presence of approximately from 0.5 to 1 per cent of free water on crystals of pure β-anhydrous lactose sufficient to alter the compound to α-lactose hydrate. Certain of the experimental data on which this conclusion is based are briefly indicated.

Solid fatty acids, W. F. BAUGHMAN and G. S. JAMIESON (*Oil and Fat Indus.*, *7* (*1930*), *No. 9*, *pp. 331*, *332*).—Noting the loss of time involved in the isolation of the total fatty acids in an anhydrous condition, the authors report systematic experiments from the U. S. D. A. Bureau of Chemistry and Soils "to determine the conditions under which the lead salt-alcohol method may be applied successfully to the oil or fat sample" directly. The procedure shown to be satisfactory for this purpose is thus stated:

"Weigh into a 300-cc. Erlenmeyer flask a quantity of the oil or fat that is estimated to contain (if possible) 1 to 1.5 gm. of solid acids, in no case using more than a 6-gm. sample." Saponify with alcoholic potash solution prepared from 40 gm. potassium hydroxide dissolved in 1 liter of pure 95 per cent ethyl alcohol. "Forty cc. of this solution are sufficient to saponify a 6-gm. sample. After saponification add a few drops of phenolphthalein indicator, neutralize the excess potassium hydroxide with glacial acetic acid from a burette, and add 1 drop of acid in excess. Add sufficient 95 per cent alcohol to bring the volume to 150 cc. Dissolve 5 gm. of lead acetate in 50 cc. of alcohol. Heat both solutions to boiling and pour the lead acetate solution into the soap solution. Allow this to cool slowly to room temperature, and leave it over night in an ice box at approximately 15° C. Filter through an 11-cm. filter paper and wash the precipitate and flask with cold 95 per cent alcohol until a sample of the washings, diluted with water, remains clear. Wash the precipitate completely from the filter through a wide stem funnel back into the flask with about 100 cc. of alcohol, add 0.5 cc. glacial acetic acid, and heat to boiling. The precipitate will slowly dissolve.

"Cool the solution slowly to room temperature and again allow to remain over night in the ice box at 15°. Filter and wash with alcohol as before. Transfer the precipitate from the filter and flask into a 500-cc. separatory funnel with ethyl ether, add about 25 cc. hydrochloric acid (1–1) to decompose the lead salts, and shake. Also decompose the small amount of lead salts adhering to the sides of the flask with a little hydrochloric acid and wash into the separatory funnel with ether. Wash the ethereal solution of solid acids with water until the washings remain clear when tested with an aqueous silver nitrate solution. Dehydrate the ethereal solution with 6 or 7 gm. anhydrous sodium sulfate. Pour the solution through a 7-cm. filter into a weighed 200-cc. Erlenmeyer flask. Wash the separatory funnel and filter with several portions of ether. Distill off the ether, heat the flask in an oven at approximately 110° (in an atmosphere of carbon dioxide if iso-oleic acid is present) until the weight is constant, and obtain the weight of the solid fatty acids. Determine the iodine number of the solid fatty acids."

The figures thus obtained are shown to "agree favorably with the results obtained by the original Twitchell method and by the lead salt-ether method."

Preparation of synthetic resins from alkali lignin, M. PHILLIPS and H. D. WEIHE (*Indus. and Engin. Chem.*, *23* (*1931*), *No. 3*, *pp. 286*, *287*).—Synthetic resins were prepared by the U. S. D. A. Bureau of Chemistry and Soils by con-

densing lignin with furfural and with the following aromatic amines: Aniline, *o*-toluidine, *p*-toluidine, cymidine, *o*-nitraniline, *p*-nitraniline, dimethylaniline, *m*-toluylenediamine, benzidine, tolidine, α-napththylamine, and β-naphthylamine. A study of the optimum conditions for preparing these resins was made, and their possibilities as varnishes and as binders in the preparation of artificial board from paper were investigated.

Para rubber seed oil, G. S. Jamieson and W. F. Baughman (*Oil and Fat Indus., 7 (1930), No. 11, pp. 419–421, 437*).—An examination by the U. S. D. A. Bureau of Chemistry and Soils of the chemical components of an oil present to the extent of about 40 to 50 per cent in the kernels of the seed produced at the rate of about 300 lbs. of seed per acre on plantations of *Hevea brasiliensis* is reported. The usual data with respect to chemical and physical characteristics and fatty acid components of the saturated and of the unsaturated types are given, and the possible utilization of rubber seed oil in the paint and varnish industries is briefly discussed. The chemical composition was found to indicate drying properties much better than those actually observed in drying tests, and in this connection it is noted that "apparently rubber seeds are so sensitive that they die shortly after maturity, and then a considerable portion of the fatty acids are liberated from the glycerides by the hydrolytic enzymes in the seeds. If the oil is filtered soon after manufacture its acidity upon standing increases very slowly." The high acid value of the soil as ordinarily obtained appeared partly responsible for the unsatisfactory drying properties observed in some samples.

The destructive action of finely divided solids on vitamin A, J. K. Marcus (*Jour. Biol. Chem., 90 (1931), No. 2, pp. 507–513*).—Data are reported showing general destruction, though at varying rates, of vitamin A deposited on various powdered materials from concentrates prepared from cod-liver oil by the method previously described (E. S. R., 60, p. 895). The greatest percentage destruction, 100 per cent after 15 days, took place on powdered iron, ferrous sulfate, and ferric oxide, and the least, 15 per cent in the same length of time, on hydroquinone. In these cases the powdered materials had been stored under carbon dioxide gas. The destruction was progressive, as shown by the fact that the mixture with hydroquinone lost 70 per cent of its vitamin A after 47 days. A similar increase in the extent of destruction with increased time of storage was also noted with sodium hypophosphite. In a mixture of the vitamin A concentrate with the U. S. P. basal diet for vitamin A assay, there was 85 per cent destruction of the vitamin in 10 days whether the mixture was stored in air or carbon dioxide.

These data suggested the probability that the destruction was one of oxidation from air adsorbed on the powder. However, reduced Nuchar was as destructive as was the char before reduction, thus suggesting that the Nuchar may have acted as a catalyst both in the oxidation and the reduction of vitamin A, or that it may have brought about a condensation or polymerization of vitamin A. Both hydroquinone and water exerted an inhibiting action on the destruction of vitamin A. It is suggested that in the former case the hydroquinone may have prolonged the induction period, while in the latter the water may have altered the surface of the powder and thus diminished its catalytic activity.

The findings are thought to raise grave doubts concerning the validity of the conclusions drawn from vitamin A assays in which the test product was combined with the dry powdered basal ration for a supply of one or more months' test feeding. It is suggested that it may be possible to prepare a vitamin A-free casein by simply storing the dry casein powder for a period of

time instead of submitting it to the tedious and expensive alcohol extraction process.

Products of the thermophilic fermentation of cellulose, S. W. SCOTT, E. B. FRED, and W. H. PETERSON (*Indus. and Engin. Chem., 22 (1930), No. 7, pp. 731–735, fig. 1*).—The end products of the thermophilic cellulose fermentation were found, in an investigation of the University of Wisconsin, to consist, to the extent of from 70 to 80 per cent, of acetic acid (45 to 65 per cent), carbon dioxide, and smaller amounts of alcohol, α-hydroxy acids, probably lactic, and residual acids—e. g., succinic.

"Some of the unaccounted-for carbon is present as a gumlike material, soluble in water, but precipitable by acetone. Glucose has been demonstrated as an end product of fermentation. The sugar was identified by the preparation and analysis of its osazone. 'Reducing sugar' calculated as glucose was in one case equivalent to 20 per cent of the fermented cellulose. Reducing compounds other than glucose are probably included in this figure. The effect of purification of the culture upon the end products was studied. Purification tended to increase the production of acetic acid and nonvolatile acids, decrease the production of alcohol and carbon dioxide, and cause the production of glucose as an end product."

Continuous fermentation in the production of lactic acid, E. O. WHITTIER and L. A. ROGERS (*Indus. and Engin. Chem., 23 (1931), No. 5, pp. 532–534*).—The U. S. D. A. Bureau of Dairy Industry reports a method for the continuous lactic acid fermentation of the lactose of sweet whey, the procedure having been operated both on the laboratory and on the plant scale. It is considered that the method "with suitable modifications should be applicable to other industrial fermentations."

Fermentations in the food industries, F. C. BLANCK (*Indus. and Engin. Chem., 22 (1930), No. 11, pp. 1166–1168*).—This paper, from the U. S. D. A. Bureau of Chemistry and Soils, presents a survey of the application of fermentation processes in the preparation of bread, tea, coffee and chocolate, sauerkraut, pickles, olives, vinegar, soy sauce, cheeses, and fermented milks, and in the preservation of fruit juices by the further reduction of the oxygen content of material sealed under reduced oxygen tension.

"Many of these reactions are not clearly understood, and the field is a most promising one for the collaboration of the chemist and microbiologist in the solutions of problems of such scientific interest and high economic value."

Some minor industrial fermentations, O. E. MAY and H. T. HERRICK (*Indus. and Engin. Chem., 22 (1930), No. 11, pp. 1172–1176*).—In a contribution from the U. S. D. A. Bureau of Chemistry and Soils, "a review is given of the production of fermentation of citric, gluconic, and gallic acids, and glycerol. Raw materials, methods of fermentation, and yields are given, together with theories concerning the mechanisms of the reactions concerned in the processes."

Relative merits of sucrose, dextrose, and levulose as used in the preservation of eggs by freezing, O. M. URBAIN and J. N. MILLER (*Indus. and Engin. Chem., 22 (1930), No. 4, pp. 355, 356*).—It was found that the white portion of eggs suffers no breakdown as the result of freezing. The physical character of the yolk portion is altered on freezing, owing to the separation and coagulation of the lecithin, but the coagulation of the lecithin may be prevented by the addition of 10 per cent by weight of dextrose or levulose, either of which is a much more effective anticoagulant than sucrose. None of these sugars form permanent combinations with the egg materials or lecithin during the freezing. The watery and ropy condition of thawed yolks may be eliminated if the yolks are frozen with dextrose or levulose and to a lesser extent with sucrose. From the standpoint of the prevention of the fermentation and

bacterial decomposition of the thawed batters, dextrose or levulose is much more effective than sucrose.

Carbon dioxide storage of fruits, vegetables, and flowers, N. C. THORNTON (*Indus. and Engin. Chem.*, *22* (*1930*), *No. 11*, *pp. 1186–1189*, *figs. 6*).—According to the results of the Boyce Thompson Institute for Plant Research, "fruits and vegetables held in storage for 3 to 7 days withstood, without apparent injury, concentrations of carbon dioxide varying from 6 to 83 per cent depending upon the kind and variety tested. The concentration of carbon dioxide tolerated by each fruit and vegetable was determined at six storage temperatures varying from 32 to 77° F (0 to 25° C.). The tolerance to carbon dioxide was influenced by the ripeness, firmness, and freshness of the plant organ. In general, the presence of an excess of moisture in the storage chamber is undesirable. The carbon dioxide treatment prolonged the life of the flowers by retarding the opening of the buds. Rosebuds, when removed to warm air after a period of storage in 15 per cent carbon dioxide for 7 days at 38 or 50° F. (3.3 to 10° C.), lasted as well as untreated roses which had been in cold storage without carbon dioxide for 3 days. This treatment gave a possible gain of 4 days."

Adsorption from solution by ash-free adsorbent charcoal, III–VI (*Jour. Phys. Chem.*, *31* (*1927*), *No. 8*, *pp. 1197–1211*; *32* (*1928*), *No. 6*, *pp. 829–842*, *fig. 1*; *34* (*1930*), *No. 12*, *pp. 2666–2692*; *Jour. Amer. Chem. Soc.*, *49* (*1927*), *No. 7*, *pp. 1686–1697*, *figs. 3*).—The four papers here noted continue a series of contributions from the Michigan Experiment Station (E. S. R., 56, p. 110).

III. *A comparison of results obtained with ash-free and impure charcoal*, E. J. Miller (pp. 1197–1211).—This section of the study brought out the fact that "all adsorbent charcoals when freed from organic and inorganic impurities and adsorbed acids have the same properties of adsorption from solution, viz, hydrolytic adsorption of salts, positive adsorption of acids, and negative adsorption of inorganic bases." The report discusses the causes of the contradictory reports on hydrolytic adsorption of salts, positive and negative adsorption of salts, and positive adsorption of bases by impure charcoal, and the significance of the results for the determination of orders of adsorbability of salts and of ions, particularly hydrogen and hydroxyl ions. Additional data have been presented in support of the contention that the supposed adsorption of bases by unpurified charcoals is due to reaction with acid impurities in the charcoal.

IV. *The non-inversion of sucrose by adsorbed acids and its significance for theories of adsorption and catalysis*, E. J. Miller and S. L. Bandemer (pp. 1686–1697).—"Evidence has been submitted to show that adsorbed acids on ash-free charcoals are unable to invert sucrose. It is suggested that adsorbed acids on charcoal are in an undissociated state. Contrary to existing ideas the adsorption of acids does not imply a high concentration of hydrogen ions around the adsorbent. The significance of the noninversion of sucrose by adsorbed acids for certain theories of adsorption and catalysis has been pointed out."

V. *Adsorption from buffer solutions as a means of determining the isoelectric point for charcoal*, E. J. Miller and S. L. Bandemer (pp. 829–842).—"Adsorption from buffer solutions by charcoals produces changes in reaction which are in keeping with the established facts of adsorption by pure adsorbent charcoals. Pure charcoal decreases the acidity of acid buffer mixtures through its ability to adsorb acids. Pure charcoal increases the alkalinity of the less alkaline buffers through hydrolytic adsorption of acid from salts, with the liberation of alkali. Pure charcoal does not reduce the alkalinity of the highly alkaline buffers because it does not adsorb the inorganic hydroxides.

Pure charcoal carrying adsorbed acids reduces the alkalinity of the more alkaline buffers by neutralization.

"Unpurified blood charcoal, as reported by previous investigators, reduces the alkalinity of the more alkaline buffers. From our work it is certain that this is due to the presence of acid impurities in the charcoal. Unpurified blood charcoal after ignition to drive off or decompose the acid impurities no longer reduces the alkalinity of the more alkaline buffers.

"The results of this investigation show that the method of adsorption from buffer solutions can not be used for the determination of the isoelectric points for charcoals. It is necessary to revise the explanations of biological phenomena which are based on erroneous data obtained with impure charcoal."

VI. *Adsorption of invertase*, E. J. Miller and S. L. Bandemer (pp. 2666–2692).—"It has been found that, as in the case of adsorption of acids by charcoal, large amounts of invertase can be adsorbed with complete loss of ability to invert sucrose. The adsorption of still larger quantities of invertase results in the retention of some activity by the invertase. Attempts to displace and to reactivate adsorbed invertase were unsuccessful. . . .

"The presence of acid in the invertase solution and of adsorbed acids on the charcoal enable the charcoal to adsorb much larger quantities of invertase from solution than are adsorbed when the charcoal is free from acid and the invertase solution neutral. Invertase adsorbed from acid solution or by charcoal carrying adsorbed acids tends to retain some of its activity, in some cases as much as 50 per cent. . . .

"It has been found that gum arabic added to an invertase solution low in yeast gum content causes the invertase to take on the adsorption behavior of invertase of high yeast gum content. Since yeast gum and gum arabic have the same effect on the adsorption behavior, it is suggested that this is additional evidence that they both function as a protective colloid for the invertase. It has been suggested that the behavior of invertase in adsorption by charcoal can be accounted for on the assumption that the 'active group' of the invertase is itself of colloidal dimensions.

"In the light of the results of this investigation the seemingly contradictory findings and conclusions of previously reported enzyme adsorption studies are accounted for and become of more value."

Adsorption from solution by ash-free adsorbent charcoal.—VI, Adsorption of invertase, E. J. Miller and S. L. Bandemer (*Michigan Sta. Quart. Bul., 13 (1931), No. 3, p. 163*).—An abstract of this and other papers of this series is noted above.

METEOROLOGY

The realm of the air: A book about weather, C. F. Talman (*Indianapolis: Bobbs-Merrill Co., 1931, pp. 318, pls. 27*).—Evidently intended for the layman, this book contains many interesting things about weather not found in textbooks and reference books on meteorology. Articles previously contributed to popular magazines and papers, reshaped, brought up to date, and combined with new material, have been used in the preparation of the volume. Parts of special interest from the viewpoint of agriculture are those dealing with hail, floods, forest-fire weather, frost protection, phenology, and weather forecasting.

Microclimate and plant climate, R. Geiger (*Handbuch der Klimatologie, herausg. von W. Köppen and R. Geiger. Band I, Teil D, Mikroklima und Pflanzenklima. Berlin: Borntraeger Bros., 1930, vol. 1, pt. D, pp. [3]+46, figs. 29*).—It is pointed out that conditions of temperature, moisture, light, and air movement may be quite different in the immediate proximity of the soil, plant cover, and other modifying factors from those recorded at ordinary

weather-observing stations, and hence require special study. Development and progress of such study are reviewed, and a considerable bibliography is appended.

Analysis of the total air temperature (sum of heat) required by the plant during its period of growth [trans. title], J. V. Figurovsky (*Pflanzenbau, 7 (1930), No. 2, pp. 36–43, figs. 4; abs. in Deut. Landw. Rundschau, 7 (1931), No. 1, pp. 20, 21*).—Analysis of data for heat requirements for different phases of development of cotton seeded at different dates and places indicated that the heat factor is a primary one in growth of cotton, that there is a functional relation between phase period and the mean temperature, and that the temperature sum required for the different phase periods is made up of two components, one of which, termed "latent heat," remains constant for each place but varies for different places. The other is termed "effective temperature." These two components play different parts in the processes of growth. Latent heat appears to be most important for growth, but effective temperature also influences the completion of the various phases of growth. Often there may be sufficient latent heat for vegetative growth, but not enough effective temperature to enable the plant to complete its phases of growth.

This is a German translation by H. Kordes.

The North Sea as a link between climate, plant growth, and migration of birds in the British Isles and in Norway. Spring near Yarmouth and at Stavanger, A. Moe (*Quart. Jour. Roy. Met. Soc. [London], 57 (1931), No. 238, pp. 35–42, figs. 2*).—Summing up the results of his study, the author states that "a comparison between spring events in the years 1917 to 1925 on either side of the North Sea shows that the events occurred 0.3 day before normal in the west and 0.4 day in the east, while the excess of temperature above normal amounted to about 2.3° F. in Norfolk (Yarmouth) and 1.3° near Stavanger."

Report on the phenological observations in the British Isles from December, 1928, to November, 1929, J. E. Clark, I. D. Margary, R. Marshall, and C. J. P. Cave (*Quart. Jour. Roy. Met. Soc. [London], 57 (1931), No. 238, pp. 31–34*).—This article summarizes and discusses the results of a continuation of observations which have been carried on for many years, with suggestions of possible ways of increasing their usefulness.

Climatological data for the United States by sections, [January-February, 1931] (*U. S. Dept. Agr., Weather Bur. Climat. Data, 18 (1931), Nos. 1, pp. [205], pls. 3, figs. 3; 2, pp. [205], pls. 3, figs. 3*).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for January and February, 1931.

Meteorological records, R. V. Allison (*Florida Sta. Rpt. 1930, pp. 115–119, fig. 1*).—Observations on temperature, rainfall, evaporation, and wind at the Everglades Substation near Belle Glade, Fla., for the year ended June 30, 1930, as compared with averages for the period of 1924–1930, are reported.

The lowest temperatures recorded during the year (at 5 ft. above the ground) was 30° F. (March 5), the highest 95° (August 6 and 11). Definite frost effects were observed upon the following dates: December 28, at 33.5°; March 4, at 33°; March 5, at 30°; March 6, at 33.5°; and March 10, at 34°. Very marked ameliorating effects of Lake Okeechobee on minimum temperatures of the adjacent land were observed. Inversion effects on night temperatures amounting in one case to as much as 10.5° within 15 ft. from the ground were also observed. Rainfall was unusually heavy during the spring months of 1930, the total for the year being 72.52 in. as compared with an average of 59.76 in. for the period 1924–1930. Evaporation, 62.2 in., was about normal.

Fire-weather service, L. G. GRAY (*Amer. Forests and Forest Life, 36 (1930), No. 8, pp. 512–514, 524, figs. 4*).—Attention is called especially to a portable radio and meteorological outfit mounted on a motor truck for use in making observations and reporting on local fire-weather conditions in the national forests.

SOILS—FERTILIZERS

[Soil fertility studies in Alabama] (*Alabama Sta. Rpt. 1930, pp. 20–24*).—This report discusses several topics, including the following:

The nature of the buffer capacity of soils, L. D. Baver.—"The buffering properties of the soil were found to be solely dependent upon the amount and nature of the colloidal acids present and primarily a function of the mineral colloidal acids. Organic colloidal material appeared to buffer soils only in the neutral and slightly alkaline regions. Extraction of soluble Al_2O_3, Fe_2O_3, and SiO_2 did not materially affect the buffering properties." Phosphate applied in quantities equivalent to 10 tons an acre of 16 per cent superphosphate failed to increase the buffering capacity of the soil, and "treatment of soils with strong mineral acids in order to increase their acidity was found to materially alter the physicochemical properties of soils."

The nature of the inner layer of colloidal clays, L. D. Baver.—It is stated that "the data showed that replacement of the Ba or Ca ions [in electrodialyzed colloids saturated with Ba and Ca ions] was not influenced except at temperatures above 80° C. Above this temperature replacement of Ca by KCl increased. This strongly indicates that the replacement of divalent cations from the soil exchange complex is not dependent upon the OH ion as part of the inner layer."

A comparative study of soil types, W. W. Pate.—It is stated that "the soils and subsoils from northwest Alabama have a higher replaceable base content than the true Norfolk fine sandy loams or fine sands from south Alabama. This may be due to the higher percentage of silt in the former as a result of weathering from sandstones and shales. The clay content of the soils from the two localities was almost identical. Exchangeable H was higher in the true Norfolk surface soils. In the subsoils, however, H was higher in the northwest Alabama samples. The same order existed for the total exchange capacity. Analyses of the colloids showed that SiO_2 was somewhat higher in the soils and subsoils from northwest Alabama, while the Al_2O_3 content was considerably lower than in the true Norfolks; the Fe_2O_3 content of the colloids was practically the same. The SiO_2-sesquioxide ratio, therefore, for the south Alabama soils was lower than for the north Alabama soils. This agrees with the generally accepted theories concerning the effect of climate on profile development. Plant growth on the soils from northwest Alabama was approximately 35 per cent higher than on the true Norfolk fine sandy loams from south Alabama. The fine sands produced better crops than the fine sandy loams when a complete fertilizer was applied. Plants showed a greater response to lime on the true Norfolk fine sandy loams than on other soils studied."

[Soil and fertilizer work of the Florida Station], R. W. RUPRECHT and R. V. ALLISON (*Florida Sta. Rpt. 1930, pp. 58, 59, 60, 61, 62, 122–124, 125–127, 129, fig. 1*).—The report includes the following items, continuing earlier work (E. S. R., 63, p. 613).

The cause of poor crop growth due to liming sandy soils.—The replaceable calcium content of Norfolk medium fine sand was so far increased by liming that the replaceable calcium: replaceable potassium ratio precluded a potas-

sium supply adequate without the addition of potassic fertilizer. The increase in the replaceable calcium, together with the low biological activity in these soils, so affected the soil solution that the plant could not obtain sufficient potassium even with applications of nitrogenous fertilizers well above the average. The starvation was overcome by applying potassium salts or by increasing the biological activity of the soil.

Determination of the effect of green manures on composition of soil.—"The nitrate content of the soil of the plats where leguminous winter cover crops were grown and incorporated was higher than where nonlegumes or no cover crop was grown. The winter cover crops during their growth utilized the nitrates formed from a summer cover crop which had been incorporated in the soil. This was particularly true of the nonleguminous winter cover crops. . . . The lysimeter planted to a rotation containing a summer legume, winter nonlegume, followed by a cash crop, showed less than half as great a loss of potash and magnesium as did the lysimeter on which a cash crop and no cover crop was grown. There was also a conservation of nitrogen in the lysimeter growing a cover crop."

A study of the decomposition of forest, range, and pasture growths to form soil organic matter.—"Preliminary work with Bahia sod grown in lysimeters and fertilized with nitrate of soda has shown that when the grass is cut frequently, every week, more nitrogen is utilized than when it is cut less frequently. The grass that was allowed to mature before cutting used the least amount of nitrogen. The heavy utilization of the nitrogen by the frequently cut grass has apparently caused a deflocculation of the soil by the sodium of the sodium nitrate, as colloidal material has come through in the drainage from these tanks. Preliminary work on forest soils has indicated that the chief effect of burning is to deplete the organic matter and nitrogen in the soil."

Field fertilizer experiments.—On saw grass peat at the Everglades substation, "in the absence of copper in the fertilizer mixture, regardless of what other ingredients were involved, all varieties of cane have continued to give entirely negative results into the present year, which is the third year of the experiment." Potassium was needed, but superphosphate caused an injury curable by manganese treatment. Where soils have been made alkaline by burning over or otherwise, manganese sulfate "continues to show exceptionally fine results." Where the alkalinity had become so severe as to render the manganese ineffective, additional treatment either with sulfuric acid or with sulfur was useful. "Studies with a considerable number of . . . field and truck crops continue to show unusually favorable results with the use of manganese incorporated in the fertilizer mixture, especially under the conditions of such abnormally alkaline soil conditions."

Soils investigations.—The tests noted of Everglades soils "have been confined largely to pot culture work and to leaching studies in the greenhouse. . . . The work with manganese has borne out the results of earlier studies in indicating its importance to plant development under certain conditions and has indicated the entire inability of copper to take its place under such circumstances. Usually the work has pointed to a decrease in the need for copper treatment upon soil that has been burned even where this need has been paramount prior to such burning." Soil moisture relations were found important in developing the injury from superphosphate treatment referred to above. In the leaching experiments, "comparatively heavy treatments that varied as to combination of copper, manganese, phosphoric acid, and potash were made, and leachings made with distilled water before the first crop (cowpeas) was planted. Analyses of the leachings showed practically no loss of any one of

the four elements involved, and this fact has been supported by subsequent plant growth."

The rôle of special elements in plant development upon the peat and muck soils of the Everglades.—The principal emphasis has been placed on the copper work, especially to determine if the effect be in the plant itself or in the soil environment of the plant. "Practically normal development has followed the working of copper directly into most any part of the plant system in any one of a number of ways. In this way contact of the treatment with the soil itself was entirely avoided. Rather marked response . . . has been obtained in this way with the use of metallic copper when placed directly into the seed piece of sugarcane. Unusual results also have been obtained with layering of canes from parent stools having full access to copper treatment in the soil."

Soil survey of Crawford County, Kansas, M. H. LAYTON ET AL. (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpt.], Ser. 1928, No. 3, pp. 20, fig. 1, map 1*).—Crawford County, Kansas, lies in the southeastern corner of the State, forms "part of a plain which has been dissected very slightly but which is itself a product of erosion and which may be considered a plain of denudation" and, though the underdrainage is less satisfactory, has a surface drainage generally good.

About 90 per cent of the lands of Crawford County were found to consist of tillable soils, of which Parsons silt loam, 41.6 per cent of the total area, was found the most extensive, Summit silty clay loam following with 18.8 per cent, and Cherokee silt loam with 11.3 per cent. A total of 1.3 per cent of mine pits and dumps constituted the only unclassified material found. In all, nine series inclusive of 12 types are mapped and described. The pH values of three types and analyses of Cherokee silt loam are included.

The survey was made in cooperation with the Kansas Experiment Station.

Soil survey of St. Lawrence County, New York, C. LOUNSBURY ET AL. (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpt.], Ser. 1925, No. 34, pp. 44, pls. 2, fig. 1, maps 2*).—St. Lawrence County lies in the northern part of New York State, possesses an area of 1,306,240 acres, has surface features largely the result of glaciation, and is drained northward to the St. Lawrence River.

The soils of St. Lawrence County are classified as 18 series inclusive of 31 types, Gloucester rocky loam 11.6 per cent, Madrid loam 11.1 per cent, and Vergennes clay loam 10.8 per cent being most extensive, while the 12.5 per cent of material not classified consisted chiefly of peat 6.6 and rock outcrop 5.2 per cent.

The survey was made in cooperation with the New York State College of Agriculture.

Soil survey of Manitowoc County, Wisconsin, A. C. ANDERSON ET AL. (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpt.], Ser. 1926, No. 34, pp. 28, fig. 1, map 1*).—Manitowoc County, east-central Wisconsin, has an area of 377,600 acres and ranges in surface from level to hilly.

The soils of Manitowoc County as mapped and described consist of Kewaunee silty clay loam covering 23.4 per cent of the total area surveyed, Bellefontaine silt loam occupying 14.2 per cent, and 29 other types of a total of 19 series. Of 5.4 per cent of unclassified material, peat constitutes 4.6 per cent.

The survey was made in cooperation with the Wisconsin Geological and Natural History Survey and the Wisconsin College of Agriculture.

The base exchange properties of soil organic matter, W. T. MCGEORGE (*Jour. Amer. Soc. Agron., 23 (1931), No. 5, pp. 331–336*).—The base exchange capacity of various lignin preparations, of a xylan preparation from wheat

straw, etc., were considered in comparison with the same property as shown by zeolites (E. S. R., 62, p. 506), in a further study at the Arizona Experiment Station of the base exchange capacity of the organic components of soils (E. S. R., 63, p. 619). The survey presented in the new work led to the opinion that "the following should be emphasized especially: (a) The definite relationship existing between the organic C content of soils and their exchange capacities; (b) the value of H_2O_2 in determining quantitatively the organic exchange capacities of soils; (c) the exchange property of lignin and lignin-like bodies; (d) the similarity in chemical properties of the basic and acid salts of lignates and zeolites, such as hydrolysis, ionization, and the common-ion effect; and (e) the exchange capacity of unchanged plant materials which possibly leads us into a field slightly foreign to soil study. It is felt that the exchange property of green manures is one of considerable economic importance to agronomic practice and one which has been largely overlooked."

Photosensitized oxidation of ammonia and ammonium salts and the problem of nitrification in soils, G. G. Rao and N. R. Dhar (*Soil Sci., 31 (1931), No. 5, pp. 379–384*).—Oxidation of ammonia and of its salts in solution to the nitrite form was found by the authors of this contribution from the University of Allahabad, India, to be effected by sunlight in the presence of certain photosensitizing substances, the velocity observed having been greater in quartz than in glass vessels. In order from greater to less effectiveness as sensitizers of the oxidation in question, the substances studied were: Titanium oxide, zinc oxide, cadmium oxide, sodium uranate, aluminum oxide, and silicon dioxide. "Basicity favors the oxidation and acidity decreases the velocity of oxidation.

"On the basis of the foregoing experiments, a new mechanism for the nitrification in soils has been suggested. We believe that the nitrification in soils is, at least in part, photochemical in nature, taking place at the surface of various photocatalysts present in the soil under the influence of sunlight.

"The bacterial explanation of the soil nitrification process has been shown to be inadequate. Facts which do not fit with this hypothesis have been shown to be explicable on the photochemical hypothesis. We believe that the bacterial and photochemical processes take place side by side."

Changes produced in nitrogenous compounds by Rhizobium meliloti and Rhizobium japonicum, G. G. Pohlman (*Soil Sci., 31 (1931), No. 5, pp. 385–406*).—Report is made from the Iowa State College of a study of the changes in nitrogenous compounds in solution produced by *R. meliloti* and *R. japonicum*. It was found that "ammonia was produced by *R. meliloti* from glycocoll, *dl*-alanine, *dl*-amino-n-butyric acid, asparagine, and urea. *R. japonicum* produced ammonia from *dl*-alanine, asparagine, and urea. Nitrates were utilized by both of the species tested. All of the inoculated solutions containing nitrates showed an increase in nitrites, which were probably produced during the utilization of the nitrates. Nitrites were apparently utilized in small amounts by *R. meliloti* and *R. japonicum*. Some of the nitrogen present in the amino group in glycocoll, *dl*-alanine, *dl*-amino-n-butyric acid, *d*-glutamic acid, *l*-cystine, and *l*-tyrosine was changed by *R. meliloti*. Changes in the amino nitrogen in *dl*-alanine, *d*-glutamic acid, *l*-cystine, and *l*-tyrosine were produced by *R. japonicum*. Differences in the changes produced by *R. meliloti* and *R. japonicum* were noted in glycocoll, *l*-tyrosine, *dl*-amino-n-butyric acid, and urea. Differences were found in the action of the type A and the type B strains of *R. meliloti* in *dl*-alanine, *dl*-amino-n-butyric acid, and *l*-tyrosine. Differences also appeared in the changes produced by the type A and the type B strains of *R. japonicum* in *dl*-alanine, *l*-tyrosine, *d*-glutamic acid, *l*-cystine, *p*-amino benzoic acid, and asparagine."

Phosphorus assimilation by soil microörganisms, L. G. THOMPSON, JR., F. B. SMITH, and P. E. BROWN (*Soil Sci., 31 (1931), No. 6, pp. 431–436*).—The present contribution from the Iowa State College covers an extension of work previously noted (E. S. R., 63, p. 216), recording the following among other observations:

"*Aspergillus luchuensis* increased the H-ion concentration of liquid culture media considerably in 11 days to 2 weeks, but the reaction became less acid as the incubation period was increased. *A. minutus* decreased the H-ion concentration in dextrose solution cultures after 2 weeks. This organism did not produce as much mycelium as *A. luchuensis*, but it contained a larger percentage of phosphorus and assimilated more phosphate. . . . The phosphorus assimilation by *A. luchuensis* was small in dextrin and sucrose solution cultures. *Azotobacter chroococcum* assimilated more phosphorus for the first 45 days than was made available, but for the second period of 45 days more phosphorus was made available than was utilized. The addition of insoluble phosphate increased the amount of phosphorus assimilated during the first 45 days of the experiment and also increased the amount of water-soluble phosphorus during the second 45 days. The native soil flora of Carrington loam was more effective in dissolving tricalcium phosphate than was *A. chroococcum*.

"Different species of soil microorganisms probably affect the water-soluble phosphorus differently, for some species may have a greater dissolving action than assimilating power, whereas with other species the reverse may be the case."

The role of protozoa in activated sludge, R. CRAMER (*Indus. and Engin. Chem., 23 (1931), No. 3, pp. 309–313, figs. 4*).—Research work performed in the laboratory of the Milwaukee Sewerage Commission brought out the essentially biochemical character of the activated-sludge process of sewage purification. "These experiments indicate that clarification of sewage can be accomplished by this process if the following conditions exist simultaneously: Aerobic bacterial life, live protozoa, and oxygen in solution. The significance of these facts and their practical implication are briefly discussed. Microphotographs of some organisms which are active in the purification process are given."

The interrelationships of certain single-valued soil properties, G. B. BODMAN and E. P. PERRY (*Soil Sci., 31 (1931), No. 5, pp. 365–378, figs. 2*).—Measurement was made at the University of California of the "single valued" soil properties, colloid content by adsorption, clay finer than 2μ and clay finer than 1μ following treatment with hydrogen peroxide and hydrochloric acid, clay finer than 1μ following shaking with aqueous ammonia, the air-dry moisture content, the moisture equivalent, the sticky point, and the rolling-out limit upon a wide variety of soils.

"A comparison of the results for the measurement of colloid by adsorption and clay fractions representing different upper size limits showed that the adsorption method gave higher results on the whole than were obtained for a measure of the peroxide-hydrochloric acid dispersed clay finer than 2μ, and that the clay finer than 1μ constituted on the average nearly 90 per cent of the total clay having 2μ as the upper limit, for soils of varying clay content. The ammonia pretreatment yielded much lower quantities of clay finer than 1μ than did the peroxide-hydrochloric acid pretreatment. The results indicate that the international method of dispersion and analysis does not permit complete expression of the probable colloid content of a soil, possibly because of indispersible colloid shells at the particle surfaces, and because of the presence of micropores, neither of which is taken into account by a mere expression of size distribution.

"Significantly high correlations were found to exist between the moisture equivalent and the sticky point, colloid and moisture equivalent, colloid and sticky point, moisture equivalent and nonsticky plastic range, colloid and air-dry moisture content, colloid and clay finer than 2μ, and moisture equivalent and rolling-out limit, these being here arranged in descending order of their correlation coefficients. Correlations of a lower order were obtained for clay and sticky point, clay and moisture equivalent, and colloid and rolling-out limit. No significant correlation was found between clay and rolling-out limit. The utility of the relationship between the laboratory air-dry moisture content and the colloid content by adsorption is pointed out.

"It is suggested that the sticky point and the rolling-out limit may have considerable significance in the rapid appraisal of soil moisture conditions in the field. A coincidence, or even an inversion, in the values of the sticky point and the rolling-out limit, for which the sticky point is normally the higher, may be expected to occur with soils having a moisture equivalent in the neighborhood of 9.8 per cent."

Chemical and physical composition of certain finely divided natural phosphates from Florida, W. L. Hill, K. D. Jacob, L. T. Alexander, and H. L. Marshall (*Indus. and Engin. Chem., 22 (1930), No. 12, pp. 1392–1396, fig. 1*).—A study of natural soft phosphates and waste-pond deposits by the U. S. D. A. Bureau of Chemistry and Soils, yielded "data on the physical composition of the samples, effect of temperature on the physical composition, specific gravity, chemical composition of the original phosphates and the mechanical fractions separated therefrom, and the solubility of the phosphoric acid in neutral ammonium citrate and 2 per cent citric acid solutions" with respect to the Florida phosphatic minerals examined.

Composition of citrate-insoluble residues from superphosphates and ammoniated superphosphates, K. D. Jacob, W. L. Hill, W. H. Ross, and L. F. Rader, jr. (*Indus. and Engin. Chem., 22 (1930), No. 12, pp. 1385–1392*).—From an investigation of the reactions of 11 phosphatic materials the authors of this contribution from the U. S. D. A. Bureau of Chemistry and Soils drew conclusions as follows:

"In the case of phosphate rock and nonammoniated ordinary and triple superphosphates, reducing the weight of sample from 2 gm. to 0.5 gm. does not result in a significant decrease in the percentage of citrate-insoluble phosphoric acid found by analysis when 100 cc. of citrate solution are used in each case. Reducing the weight of sample results, however, in significant decreases in the citrate-insoluble phosphoric acid in tricalcium phosphate and in highly ammoniated ordinary and triple superphosphates. The solubility of water-insoluble phosphates in neutral ammonium citrate solution is reduced by the presence of calcium sulfate, which is soluble in citrate solution. As determined by the Official method of analysis, the citrate solubility of water-insoluble phosphates depends on the type and quantity of phosphate compound, or compounds, present. Citrate-insoluble residues obtained from ammoniated and nonammoniated superphosphates and triple superphoshates contain varying quantities of iron, aluminum, calcium, phosphoric acid, and fluorine, but little or no sulfate.

"In general, treatment of superphosphates and triple superphosphates with relatively large quantities of ammonia tends to decrease the solubility of the iron in neutral ammonium citrate solution, has little if any effect on the solubility of the aluminum, and greatly reduces the solubility of the calcium and phosphoric acid.

"Citrate-insoluble residues obtained by the large-scale extraction of processed phosphate materials contain varying and, in general, significant quantities of

citrate-soluble phosphoric acid as determined by a second treatment with citrate solution. Citrate-insoluble residues obtained from tricalcium phosphate consist wholly, or in part, of calcium hydroxyphosphate, which is less soluble than the original tricalcium phosphate in citrate solution. Citrate-insoluble residues obtained from ammoniated and nonammoniated superphosphates and triple superphosphates contain iron and aluminum phosphates and unattacked phosphate rock. In addition to these compounds, residues obtained from highly ammoniated ordinary superphosphates, extracted in the proportion of 2 gm. to 100 cc. of citrate solution, contain tricalcium phosphate, calcium hydroxyphosphate and, perhaps, some dicalcium phosphate, but when these materials are extracted in the proportion of 0.5 gm. to 100 cc. tricalcium phosphate either is absent or is present only in relatively small quantities. Dicalcium phosphate is the principal phosphate compound present in residues obtained by extracting ammoniated triple superphosphate in the proportion of 2 gm. to 100 cc. of citrate solution."

Reactions occurring during the ammoniation of superphosphate, F. G. Keenen (*Indus. and Engin. Chem., 22 (1930), No. 12, pp. 1378–1382, figs. 4*).—"It was found that up to 1 mol ammonia per mol water-soluble phosphoric anhydride (approximately 2 per cent ammonia), no loss of available phosphoric anhydride occurred. More ammonia introduced under plant conditions—i. e., no control of temperature or moisture—resulted in loss of available phosphoric anhydride directly proportional to the amount of ammonia introduced. Above 2 mols ammonia per mol water-soluble phosphoric anhydride, the equilibrium mixture consisted of monoammonium phosphate, ammonium sulfate, gypsum, and a precipitated calcium phosphate approximating tricalcium phosphate. The tricalcium phosphate so formed is of entirely different chemical and physical behavior than mineral rock phosphate. Under laboratory conditions—i. e., control of temperature and moisture—the reactions follow different courses, but in all cases result in the same final equilibrium mixture."

[Fertilizer investigations of the Wisconsin Station] (*Wisconsin Sta. Bul. 420 (1931), pp. 42, 43, fig. 1*).—For the drained marshlands (deep peat) under experiment at the Coddington Substation, potassium compounds were found the first fertilizer need. "From 200 to 300 lbs. of muriate of potash to the acre is required to produce satisfactory yields. This is supplemented with some superphosphates applied in rows." A further observation was that 8 tons per acre of manure and 150 lbs. of muriate of potash both improve the yields, but neither alone is adequate to meet the potash needs of a 4-year rotation. Lime was shown not to be effective for crop increases. Superphosphate was detrimental to some crops, tending, for example, to increase the lodging of grains, but increased potato yields.

A method of application designed to insure proper distribution of fertilizers in field trials with fruit trees, L. R. McKinnon and O. Lilleland (*Soil Sci., 31 (1931), No. 5, pp. 407–411, figs. 2*).—The device described in this contribution from the University of California consists essentially of a ¼-in. pipe of a length such as to reach the desired depth in the soil, provided at its upper end with a coupling for connection with a spraying outfit of the usual form and at its lower end with a sharpened nozzle drilled with a ⅛-in. outlet. For convenient handling a spade handle was attached to the upper end of the injector here illustrated. No difficulty was encountered in forcing the "injection rod" into the ground when a good pressure was maintained. With two injectors in operation at the same time, it is recommended that a pressure of 200 lbs. be used.

"In the experimental field work it was possible to distribute 50 gal. of solution over the 200 sq. ft. at the approximate rate of one hole to every square

foot to a depth of 3 ft. The time consumed in this operation with two men working was about 15 minutes."

Registration, labeling, inspection, and sale of commercial fertilizers, 1930, F. B. Mumford and L. D. Haigh (*Missouri Sta. Bul. 298 (1931), pp. 45*).—The bulletin consists of the usual analyses of samples collected in the fall of 1930 and related information (E. S. R., 64, p. 817).

AGRICULTURAL BOTANY

[Botanical investigations at the Wisconsin Station] (*Wisconsin Sta. Bul. 420 (1931), pp. 38, 39, 117–121, figs. 2*).—A brief description is offered of a procedure developed by S. T. Dexter, L. F. Graber, and W. E. Tottingham, whereby the electrical conductivity of the solution obtained from previously frozen tissue is measured as an index to the hardiness of the plant. The application of the method to clovers and winter grains, as well as alfalfa, was satisfactorily demonstrated.

Studies by I. L. Baldwin and E. B. Fred on the effectiveness of rhizobia as influenced by passage through the host plant are briefly discussed.

Work by R. W. Hofer and Fred indicated that changes in the physiological character of organisms, as regards their relationship with the leguminous host plant, may be induced in the laboratory by growing the bacteria for a considerable period on a nitrogen-rich medium.

A laboratory method based on the principle that certain chemical compounds have the specific ability to stimulate the growth of certain microorganisms was perfected by O. N. Allen and Baldwin for isolating root nodule bacteria from other soil organisms.

W. P. Allyn and Baldwin found that the oxidation and reduction character of the medium on which the organisms grow exerts a pronounced influence on their growth. Whether the oxygen is taken from the air or from the growth medium, provision for the proper oxidation and reduction balance is deemed of utmost importance.

That at least two species of soil bacteria, *Bacillus subtilis* and *B. coli*, inhibit the development of alfalfa bacteria was demonstrated by K. Konishi and Fred in liquid cultures but not in soils.

An extensive study conducted by L. Almon and Fred on the single cell colony basis showed little, if any, reliable evidence of reproduction of root bacterioids. On the other hand, 37 out of 156 rod isolations did reproduce.

P. W. Wilson, E. W. Hopkins, and E. D. Kullman, working with Fred and W. H. Peterson, succeeded in producing red clover plants on which no organism except *Rhizobium trifolii* was present. It was found that under these conditions clover plants stored up nitrogen in excess of that present in the nutrient solution, whereas control plants failed to fix nitrogen. Indications were obtained that these bacteria are unable to utilize atmospheric nitrogen when grown without legumes. See also a previous note (E. S. R., 63, p. 214.)

Some factors affecting amount and nature of flora in central Kansas, W. J. Robinson (*Kans. Acad. Sci. Trans., 32 (1929), pp. 55–59*).—In such conditions as exist in central Kansas little relation is apparent between the mechanical composition and humus content of the soil and the amount of vegetation produced. Soil moisture above a certain amount also shows little effect on the nature or amount of plant life. It is supposed, however, that the range of soil temperature and the rate of evaporation are in direct relation to the amount of vegetation produced. The flora of central Kansas is xerophytic and is the resultant of successful adaptations to conditions favoring rapid evaporation.

Studies in autolysis.—I, Autolysis in seeds, A. W. Barton (*Kans. Acad. Sci. Trans.*, *32* (*1929*), *pp. 34–36*).—It appears from these experiments, undertaken to ascertain the maximum enzyme action under varying conditions of substrate and media and to determine the products of such autolysis, that in beans and other seeds not thoroughly sterile disintegration of the seed or of other substrates begins in a few days and runs for 10 to 20 days. Where sterilization is complete no autolytic changes occur. Germination results on restoration of conditions favorable thereto, showing that no changes of great physiological importance have taken place.

The effect of long-continued soaking on seed germination, A. W. Barton (*Kans. Acad. Sci. Trans.*, *32* (*1929*), *p. 37*).—From experimentation very briefly indicated, it is thought that the capacity for germination is not destroyed by long-continued soaking in sterile media; that destructive internal changes are not produced by seed enzymes or ferments; and that any change occurring within the seeds does not affect viability and does not become visible.

A natural proof that the root tip alone is sensitive to the gravitational stimulus, II, F. M. Andrews (*Ind. Acad. Sci. Proc.*, *44* (*1928*), *pp. 87–89*).—The author describes results of observation and experimentation as made before and since 1905 regarding the effects of gravitation on root tip specimens of *Zea mays* which had been inclosed accidentally, or naturally and afterwards accidentally discovered, and which carried masses of tissue around the root tip. Experimentation was carried out also using glass tube tips to cap the rootlets. These tubes were very carefully made, each with a closed end.

It is held that by no possibility does the geotropic perception lie, as has been suggested, in the root cap. It is supposed to lie in the apex of the root.

Positive gas and water pressure in oaks, C. A. Abell and C. R. Hursh (*Science*, *73* (*1931*), *No. 1895*, *p. 449*).—A report is given of water and gas pressures observed in oak trees bored with an increment borer. In one case a liquid stream was ejected 3 or 4 ft. from the base of a scarlet oak tree (*Quercus coccinea*).

An inflammable gas was forced out of increment borer holes in chestnut oak (*Q. montana*) and white oak (*Q. alba*). The trees from which the gas was forced were affected by a dry rot in each case. The gas was believed to be methane, a product of the decomposition of cellulose.

GENETICS

Metaxenia in cotton, G. J. Harrison (*Jour. Agr. Research* [*U. S.*], *42* (*1931*), *No. 9*, *pp. 521–544*, *figs. 4*).—Experiments at Sacaton, Ariz., wherein metaxenia, or immediate effects of pollen on tissues of the mother plant, was found to occur in cotton, were suggested by the discovery of this phenomenon in the date palm (*Phoenix* sp.) by Nixon (E. S. R., 59, p. 45) and Swingle (E. S. R., 59, p. 521). Metaxenia effects were shown most clearly in length of lint hairs and quantity of fuzz, both properties of the seed coat, which belongs to the body of the mother plant. The time for boll development also was influenced by the kind of pollen but in much less degree than for the maturation of the date fruits in Nixon's experiments.

Metaxenia effects so far discovered in cotton paralleled closely the parental relations of the characters. Pollen of the quickly maturing, short linted, smooth seeded Hopi cotton, when applied to the flowers of the slowly maturing, long linted, relatively fuzzy seeded Pima cotton, reduced the length of the boll period, shortened the lint 7.5 per cent, and reduced the fuzz on the seeds. Conversely, Pima pollen applied to flowers of the quicker maturing and shorter linted

Durango and Acala cottons increased significantly the length of the boll period and lint length. Pollen of Acala applied to Pima flowers significantly shortened the boll period and decreased lint length. Cross-fertilizations between Durango and Hopi did not affect significantly the time required for boll development, but the lint length on Durango plants was reduced to the extent of 6.1 per cent by fertilization with pollen of the shorter linted Hopi. Hybrid vigor was much greater in the wide crosses Pima×Hopi, Durango×Pima, and Pima×Acala than in that between species of the same group, Durango×Hopi.

The theory of Swingle, attributing metaxenia in Phoenix to a hormone-like action of substances secreted by the embryo or endosperm, seemed to account equally well for the effects obtained in Gossypium. The metaxenia effect on length of lint of cotton suggested the danger of growing two or more varieties of widely divergent staple lengths in the same vicinity, since the uniformity of both products may be impaired to the extent that cross-fertilization occurs.

Inheritance of dwarf branching habit in a new variety of sweet clover and its potential economic value in breeding, L. E. Kirk (*Sci. Agr., 11 (1931), No. 6, pp. 315–325, figs. 5*).—An inheritance study was made at the University of Saskatchewan in crosses between Arctic common white-flowered biennial sweetclover and Alpha, a new white-flowered biennial sweetclover. The character complex consistently differentiating these varieties is the fine stemmed dwarf branching habit of Alpha. F_2 families produced very closely to a 3 to 1 ratio, indicating that the Alpha character depends upon a single factor difference, recessive to the typical common sweetclover type of growth. "By crossing Alpha plants with large coarse growing but well adapted types of sweetclover, it should be possible to develop varieties that are valuable for hay purposes as well as for pasture, and at the same time retain those qualities which make the coarser growing varieties suited to a particular environment."

A study of sex in the Indian hemp, R. D. Bose (*Agr. Jour. India, 25 (1930), No. 6, pp. 495–507, pl. 1*).—Observations on a mixed ganja-producing type of hemp with a high percentage of natural monoeciousness, grown at Pusa from 1925–26 to 1929–30, revealed a sex ratio of about one male to three females for the first two years. Following selection for low percentage of natural monoeciousness, the sex ratio in subsequent years fell to about 1:1. More male than female plants tended to form secondary flowers of the opposite sex. Most of such male plants developed only a very few female flowers, whereas the majority of female plants produced many secondary male flowers. No appreciable difference was apparent between the sex ratios obtained in the progeny of plants pollinated with fresh and stale pollen, respectively. There seemed to be a natural tendency in some plants of the Indian hemp to develop flowers of the opposite sex after the completion of their normal flowering. Reversals of sex brought about by mutilations and chemical treatments were believed to be but random examples of monoeciousness.

[Investigations in animal genetics at the Wisconsin Station] (*Wisconsin Sta. Bul. 420 (1931), pp. 113–116*).—The results of the following studies are reported:

No foundation for belief some bulls have ability to control sex of offspring.—A study of over 124,000 births in cattle of the breeds Swedish Red and White, Swedish Friesian, and Swedish Landraces by I. Johansson showed a sex ratio of 106.2 males per 100 females. There was no tendency for departures from the normal sex ratio to be hereditary. A higher proportion of males among the calves born prematurely, 143.07 males to 100 females, was noted, as was a greater tendency for twins to be of the female sex. Twin calves were lighter at birth and lower in vitality than singles. About 92 per cent of the heifers born twin with a bull were freemartins. Although the age of the parent had

no influence on the sex of the calves, there was a gradually increasing tendency to twinning as the cow's age advanced up to 8 or 9 years. The tendency to the production of twins was also hereditary.

An inherited type of sterility.—A type of sterility in guinea pigs which was found by E. E. Van Lone to be caused by a single recessive Mendelian factor is described. In this type of sterility the females fail to come in heat, and the sex organs of the males remain infantile and no spermatozoa are produced.

X-ray experiments with Drosophila, A. S. Serebrovsky and N. P. Dubinin, trans. by G. A. Lebedeff (*Jour. Heredity, 21 (1930), No. 6, pp. 259–265, figs. 2*).—In attempts to produce lethal mutations in the X chromosome of Drosophila by X-rays at the central genetical station in Moscow, a mutation rate as high as from 40 to 50 per cent was obtained in a few experiments with an exposure as long as four hours. In addition to the lethals a considerable variety of other mutations was also produced. One of the most frequent mutations was that of scute. In addition to the scute mutation already known, six new scute allelomorphs were found. As these affected different regions, the hypothesis was advanced that in the chromosome there is a whole region affecting the bristles and that different groups of bristles each have their own center. Portions of the gene may thus be changed, and it appears possible that the gene may be mapped. Most of the centers appeared to be placed in linear order, although two or three could not be so placed.

A preliminary note on the occurrence of a color mutation in the house mouse (Mus musculus), J. M. Murray (*Science, 73 (1931), No. 1896, p. 482*).—The occurrence of two mice resembling dilute brown in a strain of chocolate brown mice which had been inbred for about 20 generations by brother-sister or father-to-daughter matings is noted. The new color character was not in the dilution or the albino allelomorphic groups, and is recessive to the presence of chocolate brown.

The evolution of dominance in certain polymorphic species, R. A. Fisher (*Amer. Nat., 64 (1930), No. 694, pp. 385–406*).—From a study of Nabours' results with the grouse locust (E. S. R., 55, p. 26), it is shown that a deficiency of homozygous dominants is exhibited in accordance with the theory of the evolution of dominance in polymorphic species.

Winge's studies with Lebistes (E. S. R., 58, p. 627) suggest that colored genes are advantageous in the male, but disadvantageous in females.

The closeness of linkage within or between chromosomes presents an obstacle to normal evolutionary development by gene substitution, and makes it possible for abnormalities such as duplications to have an advantage, thus setting up the stability of the gene ratio necessary for polymorphism. When the advantage lies in the external appearance it will be manifest and the variant form will tend to become dominant.

Further observations on the nature of the X-prime (X′) chromosome in Sciara, C. W. Metz and H. B. Smith (*Natl. Acad. Sci. Proc., 17 (1931), No. 4, pp. 195–198*).—This paper deals with studies of the occurrence of crossing over between the X and X′ chomosomes in Sciara. No crossovers were observed, and it is concluded that crossing over between these chromosomes occurs at a very low rate if at all. Only two loci have been identified in the X chromosome, and these show only about 0.5 per cent crossing over.

Studies on the creeper fowl.—I, Genetics, W. Landauer and L. C. Dunn (*Jour. Genetics, 23 (1930), No. 3, pp. 397–413, pl. 1*).—The inheritance of the creeper traits in fowls, characterized by an extreme shortness of the long bones of the extremities, bending of the tibia, and the presence of a highly differentiated fibula, was studied at the Connecticut Storrs Experiment Station in

four distinct lines of creeper fowls from the United States, Germany, Scotland, and the Marquesas Islands.

In these studies it was found that the creeper factor was dominant. In the crosses of creepers with normals there were produced 3,337 crossbreds, of which 1,676 showed the creeper character and 1,661 were normal chicks. This included those which were hatched and those which were dead in the shell. In the inter se matings of creepers there were 775 creepers and 388 normals, giving almost perfect agreement with the expectation if the creeper factor behaves as a lethal in the homozygous condition. There was also a surplus of creepers among those found dead in the shell. Approximately 25 per cent more embryos died in the shell during the first six days of incubation in the inter se matings than in the outcross matings.

A peculiar embryonic abnormality resembling phocomelia in humans was frequently observed in inter se matings, and it is suggested that these birds represent embryos homozygous for the creeper factor. The hatched chicks in the matings of creepers with normals showed a deficiency of creepers, while the chicks failing to hatch showed a surplus of creepers, indicating that the creeper factor is slightly semilethal in the heterozygous condition. As similar results were obtained in all four strains and in crosses between them, the same factor appeared to be responsible for the creeper condition. No homozygous creeper birds lived after hatching.

"Nervous" goats, J. L. Lush (*Jour. Heredity, 21 (1930), No. 6, pp. 242–247, figs. 3*).—A flock of goats exhibiting a peculiar nervous condition resulting in an unconscious rigidity following fright is described. This appeared to be a hereditary character, as such goats occurred in Tennessee and continued to show the peculiar characteristic after they were transported to Texas.

Effect of lecithin on the sex ratio in the albino rat, H. E. Jordan and W. H. Paine (*Amer. Nat., 64 (1930), No. 694, pp. 422–429*).—In two series of experiments rats were injected subcutaneously and intraperitoneally at 3-day intervals with 2 cc. doses of a saturated solution of lecithin in vaseline oil or olive oil. A 10-day period was allowed following the last injection before mating. The sex ratios of the offspring of treated animals were 67.1 males per 100 females and 82.3 males per 100 females as contrasted with about 119 males per 100 females in the controls. However, because of the variations observed within individual litters, it is felt that these findings are not conclusive in indicating that lecithin injections increase the percentage of females.

A study of the motility and resistance of rat spermatozoa at different levels in the reproductive tract, D. E. Yochem (*Physiol. Zool., 3 (1930), No. 3, pp. 309–329, fig. 1*).—The results of a study of the duration of motility of spermatozoa in different portions of the male reproductive tract of the rat are reported. One test concerned with the influence of the abdominal temperature on the spermatozoa in the tract after removal of the testicle indicated that the abdominal temperature inactivates the spermatozoa in the head of the epididymis first, then those in the ductus deferens, and finally those in the tail of the epididymis. There were only a few slightly motile spermatozoa observed as long as 8 days.

When the epididymis and ductus deferens remained in the scrotum, live spermatozoa were found up to 16 days. The duration of motility in the different parts of the tract was similar to that observed in the abdomen.

The influence of pH on the motility and resistance of the spermatozoa was observed in normal physiological saline solution for spermatozoa removed from the testis, head of epididymis, tail of epididymis, and ductus deferens. It appeared that the resistance of the spermatozoa to acidity and alkalinity increased from the testis to the tail of the epididymis, but decreased on passing

into the ductus deferens. The motility in the normal physiological salt solution and other similar media was found to continue about 2 or 3 hours longer at the scrotal temperature of 31° C. (87.8° F.) than at the abdominal temperature of 34°. Motility was evidenced for relatively long periods at 2° for spermatozoa removed from the testis (75 hours), but decreased along the reproductive tract to 8 hours in the ductus deferens. It is suggested that since the low temperatures inhibit motility, spermatozoa showing the lowest motility are least affected. The loss of motility at each level was found to be in the reverse order of the normal increase in motility along the reproductive tract.

Fetal and early postnatal responses of rat gonads to pituitary injections, E. L. Corey (*Physiol. Zool., 3 (1930), No. 3, pp. 379–391, figs. 8*).—In studies of the part played by injections of macerated whole pituitary glands into fetal and young rats it was found that there was no response in gonad development of the fetal rat, but hastened differentiation of the gonad was observed in both sexes between the tenth and fifteenth days of postnatal life. This was more pronounced in males than in females. The injections were made into animals up to 20 days after birth.

Menstruation and the anterior pituitary, C. G. Hartman, W. M. Firor, and E. M. K. Geiling (*Soc. Expt. Biol. and Med. Proc., 28 (1930), No. 2, pp. 185–187*).—The results of a number of investigations have led to the conclusion that menstruation is closely associated with the secretions of the anterior lobe of the pituitary gland. Some of the reasons advanced for this conclusion are the abolition of the cycle following the removal of the hypophysis, the failure of ovarian hormone administration to cause bleeding in hypophysectomized animals, and the production of bleeding by the administration of the anterior lobe hormone in any form. Certain clinical aspects of these findings are pointed out with special reference to the threshold of the action of the pituitary hormone.

Effect of estrin injections on reproductive organs, hypophysis, kidney, adrenals, thyroid, and blood vascular system, M. M. Kunde, F. E. D'Amour, R. G. Gustavson, and A. J. Carlson (*Soc. Expt. Biol. and Med. Proc., 28 (1930), No. 2, pp. 122, 123*).—The injection of the female sex hormone obtained from human pregnancy urine into four immature dogs over a period of 6 to 17 weeks caused no pathological changes in the heart, arteries, liver, spleen, adrenals, and thymus. The tubules of the kidneys contained some albumin, but the glomeruli were normal. Hyperplasia of the thyroid was marked, and the anterior lobe of the hypophysis was smaller than in the normal dog, while the posterior lobe seemed relatively large. The nipples enlarged, and the external genitalia and uterus of the female dog increased in size. The ovaries were less than half the normal size, containing more stroma and no mature follicles.

An experimental study of ovariectomy and transplantation in the pregnant albino rat, W. O. Nelson and H. O. Haterius (*Physiol. Zool., 3 (1930), No. 2, pp. 231–241, pl. 1*).—The results of a study of the relation of the ovary to the maintenance of pregnancy in the rat are reported. In these experiments one ovary was removed prior to breeding. A foreign ovary was grafted in the abdominal muscles on the ninth to thirteenth day of gestation, after which the second ovary was removed. When the grafted ovary was taken from an immature female or from a female in dioestrum the young were usually carried to full term, but when the donors were in the prooestrous or oestrous stage abortion or resorption of the fetuses usually occurred. Double ovariotomy without ovarian grafts was followed within two days by abortion.

Histological studies of the grafts in cases of normal gestation showed a pronounced development of the luteal tissue, leading to the conclusion that luteal tissue is essential for the maintenance of normal pregnancy in the rat.

The corpus luteum hormone.—II, Methods of extraction, F. L. HISAW, H. L. FEVOLD, and R. K. MEYER (*Physiol. Zool., 3 (1930), No. 1, pp. 135–144*).—In continuing this series (E. S. R., 60, p. 727) a method for the extraction of the corpus luteum hormone responsible for the relaxation of the pelvic ligaments is described. This involves extraction in 95 per cent ethyl alcohol acidified with 2 per cent hydrochloric acid, after which the product is purified and a fat- and protein-free extract is obtained. The active principle is destroyed by boiling or drying above 50° C. for 48 hours. In the dried form the activity gradually decreases. The principle is stable in neutral alcohol or aqueous solutions and in fairly strong acid solutions, but is destroyed in alkaline solutions. The method of extraction described permits the separation of the following hormone from the active substances of the corpus luteum.

Ovulation in the rabbit as a diagnostic measure in early pregnancy, P. F. SCHNEIDER (*Soc. Expt. Biol. and Med. Proc., 28 (1930), No. 2, pp. 117–119*).—The use of young rabbits for diagnosing pregnancy was tested. This test consisted of the injection of from 5 to 7 cc. of urine into a female rabbit 16 weeks of age, with autopsy at 30 hours after injection. In positive cases corpora hemorrhagica or corpora lutea were present in the ovaries. The data indicated that pregnancy could be diagnosed in women at approximately 18 to 21 days.

FIELD CROPS

[Agronomic experiments in Alabama, 1930], E. L. MAYTON, H. B. TISDALE, J. T. WILLIAMSON, D. G. STURKIE, C. L. ISBELL, R. W. TAYLOR, W. D. KIMBROUGH, and J. F. DUGGAR (*Alabama Sta. Rpt. 1930, pp. 11–20, 34, 35, 36, 37*).—Variety and fertilizer tests with cotton (E. S. R., 64, p. 735), corn, potatoes, winter legumes, and grasses; breeding work with cotton, corn, and winter legumes; spacing tests with cotton and potatoes; and cutting experiments with kudzu (E. S. R., 64, p. 736), Johnson grass, and Sudan grass are reported on again (E. S. R., 64, p. 332).

In a study of factors affecting lint development in cotton, length of lint and size of boll were not affected by soil or climatic conditions but were influenced by soil moisture. Cotton grown in soil from the Mississippi Delta and in Norfolk sand under optimum moisture conditions was similar in size of bolls and in lint length. The soil moisture at or near the time of blooming markedly affected the size of boll, abundant moisture being associated with large bolls. The quantity of soil moisture present from 1 to 15 days after a flower appeared affected the length of lint produced by its boll, short lint being associated with a low moisture content at that period.

Fertilizer-rotation experiments on 10 different soil types in the State emphasized the importance of a complete fertilizer for cotton, the value of lime in a rotation including legumes for soil improvement, and the prolonged effect of ground limestone in a rotation. Basic slag compared favorably with superphosphate when both were used without lime, while superphosphate was slightly superior on limed land. The increase due to commercial fertilizer on Greenville soils was small.

In the 2-year rotation of cotton and corn, seed cotton yields averaged on plats manured 1,471 lbs., on sodium nitrate plats 1,222 lbs., and after vetch 1,231 lbs. and corn 38.3, 35.7, and 30.9 bu., respectively. Corn made its highest yields after vetch turned under April 5 and 15 and cotton after vetch turned under March 25. Legumes evidently should be turned as soon as enough growth has been made to supply a reasonable quantity of nitrogen so that cotton planting may not be delayed.

On an area sown to several clovers and Dallis grass and variously fertilized and limed, a complete fertilizer in all cases produced higher yields on both limed and unlimed plats than incomplete fertilizers. Plants responded more to nitrogen than to any other element. Nitrogen increased the percentage of Dallis grass, and phosphorus and potassium increased the percentage of both Dallis grass and legumes.

The yield and protein content of Sudan grass hay were increased by application of sodium nitrate to young grass, the most profitable rate being from 100 to 200 lbs. per acre as soon as the grass was up. The larger hay yield was produced by Sudan and Johnson grasses when cut in the blooming stage, at which time the most total nutrients were also present. The two grasses did not differ significantly in composition, although Sudan outyielded Johnson grass.

Compared with hairy vetch, Scotch vetch first bloomed 28 days earlier, narrow-leaved vetch 20 days, bitter vetch 18, monantha vetch 17, crimson clover 10 to 13, woolly-pod vetch 8, Tangier pea 5, and Oregon vetch 4 days earlier, whereas Austrian winter peas averaged 3 days later in initial blooming and purple vetch still later. Common lespedeza required from 11 to 14 days from emergence for 85 per cent of its plants to become stocked with root tubercles, whereas Korean lespedeza seedlings required from 16 to 28 days for the same result. Tennessee No. 76 and Kobe lespedeza resembled the common variety rather than Korean in this respect. Spanish peanuts from commercial seed were tardily and poorly supplied with root nodules when grown on Norfolk sandy loam where no peanuts were raised recently.

Potatoes receiving 400 lbs. of sodium nitrate used with superphosphate 1,200 lbs. and potassium chloride 250 lbs. gave more economical yields than with 600 lbs. of sodium nitrate on Norfolk sandy loams. With sodium nitrate 800 lbs. and potassium chloride 250 lbs., 1,200 lbs. of superphosphate gave a higher yield than 800 lbs. With superphosphate 1,200 lbs. and sodium nitrate 800 lbs., 200 lbs. of potassium chloride gave higher yields than 100 lbs. The yield of potatoes when all nitrogen was derived from ammonium sulfate was 135 bu., with three-fourths from ammonium sulfate and one-fourth from sodium nitrate 181 bu., and with one-fourth only from ammonium sulfate 191 bu. Ammonium sulfate in the larger quantities was injurious.

With variations of a basic fertilizer comprising superphosphate 800 lbs., sodium nitrate 400, and potassium chloride 150 lbs., yields of marketable tubers from plats receiving combinations of two and of three elements showed an increase of 72 per cent for nitrogen, 70 per cent for phosphorus, and 11 per cent for potassium. Doubling the quantity of all three materials in the basic application increased the marketable potatoes only 12 bu. at a cost of $18. Yields were about the same for potassium chloride and potassium sulfate, whereas ammonium sulfate gave a small increase over sodium nitrate. Current results supported previous findings showing no differences in shrinkage during storage or in keeping quality and only very slight differences in moisture, starch, and sugar content that could be attributed to fertilizer treatment.

[Field crop research in Florida], W. E. Stokes, R. W. Ruprecht, A. F. Camp, and W. B. Tisdale (*Florida Sta. Rpt. 1930, pp. 33–46, 59, 63, 64, 87, 88, 132–135, fig. 1*).—Continued agronomic activities (E. S. R., 63, p. 626) reported on from the station and substations included breeding work with corn, cotton, peanuts (E. S. R., 65, p. 225), and tobacco; fertilizer tests with corn, oats, rye, wheat, cotton, peanuts, winter legumes, potatoes, tobacco, and pasture; cultural (including planting) trials with corn, potatoes, and tobacco; storage tests with corn; and other pasture studies.

For pasture on Fellowship soil, centipede grass competed successfully with and crowded out Bermuda, Bahia, St. Augustine, carpet, blue couch, Dallis,

and other grasses tested. Fertilizer materially increased the yield and influenced the composition of pasture grasses. Nitrogen alone resulted in about as good increases as complete fertilizer, and seemed to increase the protein content. Frequent mowing gave about as satisfactory a yield and a higher protein content than mowing less often. When carpet, Bermuda, Bahia, and centipede grasses and a mixture of the first three were compared, all pastures carried slightly over one beef animal per acre, with the mixed pasture returning the highest live weight gain per acre.

Cutting tests with Bahia (E. S. R., 64, p. 218), carpet, and centipede grasses demonstrated that grasses cut often remain more vegetative and are higher in percentages of nitrogen and ash, indicative of high protein and greater mineral content, respectively, and consequently of superiority for feeding. Striking differences were not noted between the percentages of nitrate nitrogen in Bahia and Sudan grasses fertilized with sodium nitrate and those not treated. In lysimeter tests with Bahia grass the percentage of nitrogen in the top growth had a downward trend in the order cut frequently, cut less often, cut in the seed stage, and uncut, whereas the highest leachings of nitrates occurred with the uncut grasses and gradually decreased as the cutting was more frequent.

In work with legumes, Austrian winter peas, monantha vetch, and hairy vetch were planted cooperatively on several leading soil types of central and northwestern Florida at different dates and variously fertilized with superphosphate. October plantings were better than November plantings, but satisfactory growth could not be expected from December seedings. In Jackson and Washington Counties in northwestern Florida these crops showed a consistently marked response in yield to superphosphate, 300 lbs. per acre being about as effective as 600 lbs. Austrian peas made consistently the higher green weight per acre and had a higher moisture content than the two vetches, and hairy vetch contained a slightly higher percentage of total nitrogen than the peas or monantha vetch. Indications in other tests were for late September and early October plantings in favorable seasons and from 20 to 30 lbs. per acre for hairy vetch and from 30 to 50 lbs. for Austrian winter peas.

Potatoes at Hastings yielded best where urea was the only nitrogen source, and urea and tankage plats were second best. Sodium nitrate, ammonium sulfate, and Leunasalpeter gave better yields than when used in combination with fish scrap or tankage. As in previous years, top-dressing with sodium nitrate did not increase the yield. Neither reducing the phosphate content of the fertilizer 4 per cent nor doubling the quantity of potassium affected the yield. Potassium chloride gave as good yields as potassium sulfate.

In burn tests on shade tobacco, leaves from the third priming burned from two to six times as long as leaves from the fifth priming. In duration of burn, leaves from different fertilizer treatments differed significantly. The longest burn, 15.6 seconds, occurred on leaves from a treatment wherein nitrogen came from manure and cottonseed meal, while the shortest burn, 6.5 seconds, of leaves of similar primings took place when the nitrogen was derived equally from cottonseed meal and castor pomace. No striking differences were observed in the color of ash between any two treatments.

Application of chemicals had a retarding effect on plant height in tobacco as compared with plants receiving no chemical other than the fertilizer. Copper increased the percentage of uniformly colored leaves, while all other elements used except iron were injurious in this respect. Copper, iron, and zinc increased the duration of burn, while boron and manganese reduced it to about half that of the check.

[Field crops investigations in Wisconsin, 1929–30] (*Wisconsin Sta. Bul. 420 (1931), pp. 1–5, 32–35, 36–38, 39, 40, 43, 44, 122, figs. 5*).—The progress of agronomic experiments (E. S. R., 63, p. 31) is again reviewed.

Factors found variously responsible for the lowered productivity of Wisconsin pastures include inadequate supplies of lime, phosphorus, potassium, and nitrogen, close and heavy grazing, especially in early summer, depredations of white grubs, and the need of good species of grass and legumes to replace inferior kinds or weeds. G. B. Mortimer during two seasons secured 90 per cent more grass, previous to June 1 each year, on areas receiving lime, phosphorus, and potassium than on untreated areas typical of southern Wisconsin bluegrass pastures. With nitrogen added to the minerals the increased yield over the checks before June 1 was 216 per cent. Nitrogen fertilizer also resulted in stimulation of growth during hot summer when good pasture is at a premium. Arable land having deep, heavy soil, put into permanent pasture of mixed Kentucky bluegrass, redtop, and white clover, and grazed rotationally furnished from May 5 to October 15 on a fertilized paddock of 1.5 acres the equivalent of 433 days' pasture for one heifer in spite of dry weather, while a check paddock supplied 245 pasture days. The needs of permanent pasture plats established in southwestern Wisconsin are indicated briefly.

Alfalfa during a 15 years' test at the Hancock Substation seemed to be the best of the legumes for the well-drained light soils of the section and was followed in order of preference by sweetclover, red clover, and soybeans. Average results favored thin seedings of nurse crops for April plantings on the sandy soils. From 10 to 15 lbs. of seed per acre was as good as 15 to 20 lbs., and April sowings decidedly outyielded later plantings. Even when the temperatures in middle May fell to as low as 23° F. a good stand resulted from April seedings. On former alfalfa fields it seemed better to risk the frosts of April or May than to sow alfalfa in May and risk inadequate moisture.

Counts of the root nodule bacteria present in commercial legume cultures, according to E. D. Kullman and E. B. Fred, had best be made by using a medium containing yeast water. The plate method was most satisfactory in studying the growth of the organisms. Growth of the red clover root nodule bacteria (*Rhizobium trifolii*) was found to be very rapid for the first two days. There was much reduced acceleration of growth during the third and fourth days. The maximum number of colonies appears about the seventh day, and thereafter the death rate of the organisms increases.

Pedigree 38 barley, developed by B. D. Leith, is barbless and highly resistant to disease, has a long head, stiff straw, and plump kernels, and has outyielded other good barleys in comparative tests. Progress spring wheat developed by E. J. Delwiche is described as highly resistant to Fusarium scab and markedly more resistant to black stem rust than Marquis, the spring wheat most generally grown in the section. It outyielded other sorts in both northern and southern Wisconsin and surpassed Marquis in 1929 at Ashland in protein and gluten content.

Measurements by F. S. Henika and W. B. Ogden on 1928 crop tobacco showed leaf thickness to average 0.0032 in. for samples from southern Wisconsin and 0.0033 for northern samples, whereas burn averaged 8.7 and 20.3 seconds, respectively, indicating that the better burn of leaf from northern Wisconsin is due to some other factor or difference than leaf thickness.

Field surveys verified earlier observations (E. S. R., 62, p. 350) by Johnson and Ogden that tobacco mosaic may live over winter in the soil and subsequently infect crops planted later in such infested fields. Indications were that planting mosaic infested but otherwise desirable tobacco fields to corn for one year

and then returning with tobacco would practically control mosaic arising from the field source and without introducing into the tobacco land much of the harmful results often due to other crops in a regular rotation.

An extraordinary amount of mixed seed in the growers' fields was observed by J. Johnson. The mixed seed showed evidence of accidental or mechanical mixing of seed of different varieties, and there was clear indication of intercrossing with dozens of types often existing as a consequence in the same field. Many relatively pure strains of uncertain value also are grown in the State, and moreover, many identical strains are grown under different names. To remedy the present situation the station proposed to act as a center for the maintenance of limited supplies of pure seed for tobacco seed growers.

Sodium chlorate and calcium chlorate proved effective in destroying quack grass, Canada thistle, Austrian field cress, and other noxious weeds in trials at the station by A. L. Stone and at the Ashland, Spooner, and Sturgeon Bay Substations by Delwiche. The chief limiting factor was the cost, which varied from $20 to $75 per acre. At present prices for chlorate compounds their use in Wisconsin seemed best justified in small areas where other control methods are difficult, as along fence rows, on very stony land, in woodlands, and on small patches in pastures. At Ashland a single application of 272 lbs. per acre of either chlorate in early October eradicated a thick stand of quack grass. Of crops planted on the land the spring following the treatment, flax was little affected, corn produced about two-thirds of a crop, and oats, wheat, and barley were nearly complete failures. Experience indicated that such toxic effects remain in the soil only one year.

Variety tests of oats, barley, and spring wheat, T. A. KIESSELBACH and W. E. LYNESS (*Nebraska Sta. Bul. 253 (1931), pp. 23, figs. 8*).—Further varietal trials with spring small grain since 1923 (E. S. R., 52, p. 529) showed the superiority of Nebraska No. 21 (Kherson) and Burt (C. I. 293) oats, Comfort and Glabron (smooth awned) and Trebi (rough awned) barley, and Ceres wheat among varieties grown extensively. The acreages of spring small grains grown in Nebraska in 1930 comprised oats 2,485,000 acres, barley 725,000, and spring wheat 188,000 acres, there being a threefold increase in barley acreage during the last 3 years.

The similarity of yields and other agronomic characters in a comparison from 1920 to 1930 of home-grown and northern-grown Marquis wheat indicated that the locality of seed production had no effect upon seed value, and that the crop underwent no hereditary changes which may be associated with change of environment. Over the same period on a hull-free basis the order of acre yields was winter wheat, winter rye, Comfort barley, Nebraska No. 21 oats, spring rye, hull-less oats, white spring emmer, and hull-less barley.

Alfalfa-seed production, J. W. CARLSON and G. STEWART (*Utah Sta. Bul. 226 (1931), pp. 54, figs. 9*).—Investigations at the Uintah Basin Alfalfa-Seed Experimental Farm on the production of alfalfa seed, concerned with seeding methods, clipping or pasturing, cultivation, irrigation, manuring, varieties, harvesting, seed quality, germination, flower tripping, air conditions, seeding habit, and improvement have been noted extensively from other sources (E. S. R., 55, p. 735; 56, p. 433; 61, p. 29; 63, p. 630; 64, p. 532). The progress of inbreeding work with alfalfa is reviewed briefly.

Besides the findings noted earlier (E. S. R., 63, p. 630; 64, p. 532), it was observed that winter hardy varieties, as Grimm and Hardigan, could be expected to seed as well as less hardy ones, as Peruvian and Argentine. Utah Common did not seem to differ greatly in seeding habit from varieties either winter hardy or not. In harvesting tests it appeared that stacking could not be expected to improve greatly the quality of seed cut when extremely immature.

Quality in alfalfa seed apparently varied as a result of seasonal conditions more than because of differences in production methods. When grown under favorable field conditions true colored and plump seed had a germination value of about 51 per cent, plump discolored seed 29, and shriveled discolored seed 16 per cent. Regardless of color or plumpness, about 75 per cent of the seed that germinated in the field established strong and healthy seedlings. Observations on plants growing near hygrothermographs suggested that alfalfa might be expected to seed best under desert or semidesert conditions, where warm or hot days, cool nights, and a relatively dry air both night and day generally are encountered.

Breeding corn for resistance to the European corn borer, A. R. MARSTON (*Jour. Amer. Soc. Agron., 22 (1930), No. 12, pp. 986–992, figs. 2; abs. in Michigan Sta. Quart. Bul., 13 (1931), No. 3, pp. 163, 164*).—Efforts of the Michigan Experiment Station to develop corn resistant to the European corn borer are reviewed. While there were no significant differences in infestation suggesting that native strains of corn were resistant to borer attack, Maize Amargo, a South American corn, showed resistance and certain hybrids between it and native corns showed low percentages of infestation. The evident resistance of Maize Amargo to corn borer attack was indicated as a simple Mendelian character, recessive to that characteristic of standard Michigan corn varieties which makes them subject to heavy attack and severe damage.

Greening seed potatoes before planting, J. BUSHNELL (*Ohio Sta. Bimo. Bul. 150 (1931), pp. 97–100, figs. 2*).—The merits of greening seed potatoes before planting are discussed from experiments at the station and elsewhere and from experience. The maritime climate has made greening a standard farm practice in northeastern Europe, whereas no benefits or even reduced yields have resulted in most experiments in the United States with greening before early planting. However, for late June planting, as indicated for the production of seed potatoes, green seed of Russet Rural was decidedly superior to seed which had sprouted excessively in storage. Planting in late June is not advised ordinarily for the main crop, because larger yields come from May planting. For late June plantings for seed or because of delay due to frequent rain the seed should be removed from storage before long sprouts develop and spread in the light to green. Prolonged greening and greening in a warm greenhouse were detrimental to yield, best results being had from greening outdoors in a cold frame.

Early planted potatoes produce best quality, H. C. MOORE and J. J. BIRD (*Michigan Sta. Quart. Bul., 13 (1931), No. 3, pp. 142–145, figs. 2*).—When Russet Rural potatoes were planted in the weeks of May 12, May 26, and June 9, 1930, on 18 farms in 14 counties in Michigan the earlier planted plants produced the highest acre yields and potatoes of the best market quality. Time of planting appeared not to affect percentage of off type tubers or black scurf injury and had no marked effect on set of tubers.

Plowing depths and fertilizers affect sugar beet crop, J. C. LILL (*Michigan Sta. Quart. Bul., 13 (1931), No. 3, pp. 122–127, figs. 3*).—Sugar beets were grown near Saginaw, Mich., in cooperation with the U. S. Department of Agriculture on land plowed from 4 to 6, 6 to 8, 8 to 10, and 10 to 12 in. deep and fertilized or not with 300 lbs. of 4-12-4 complete fertilizer. The percentage increase in number of commercial roots, yield, and in sugar production per acre usually became greater as the soil was stirred deeper. However, the greatest actual increases in these factors were had from fertilized land plowed from 8 to 10 in. deep. The sucrose and purity percentages in both fertilized and

unfertilized series, various depths of plowing considered, fluctuated within narrow limits yet with a very definite trend favoring fertilizer application and deeper plowing.

HORTICULTURE

[Horticulture at the Alabama Station] (*Alabama Sta. Rpt. 1930, pp. 33–35, 36*).—Time-of-planting studies conducted by C. L. Isbell with beans showed strongly in favor of early planting, especially in the case of Lima beans. Variety tests carried out with cantaloupes, sweet corn, kale, lettuce, and peas are briefly discussed. Prosperity was the most productive of 10 peas tested.

In a fertilizer experiment with pecans in Dallas County, R. W. Taylor found that nitrate of soda added to phosphorus and potash increased yields above phosphorus and potash alone. Doubling the quantity of the complete fertilizer reduced the size of nuts but did increase yields.

As reported by W. D. Kimbrough, variations in rainfall and soil moisture had a much greater effect on the moisture, sugar content, and firmness of strawberries than did fertilizer treatments. Differences as great as 3 per cent in total sugars were found in berries harvested at different times in the same season, as compared with a maximum of 1.45 per cent due to differential fertilizer treatment. Between berries grown with and without irrigation, the differences in total sugars reached 3.32 per cent as compared with 0.72 per cent on unwatered plats receiving differential fertilizer treatments.

[Horticultural investigations at the Florida Station], R. W. Ruprecht, A. F. Camp, and J. H. Jefferies (*Florida Sta. Rpt. 1930, pp. 57, 58, 60, 61, 62, 77–86, 88, 89, 108–112, fig. 1*).—No differences were found in the yield of grapefruits and of oranges at Lake Alfred from trees receiving different quantities of potash, although the largest applications apparently exerted a harmful influence as indicated in color of the foliage. Studies there and at Vero Beach upon the effects of various potash carriers on the growth, yield, and composition of citrus produced little evidence, growth being practically the same on all the plats, and analyses of the Vero Beach fruit showed no influence of potash on composition. At Lake Harris urea and Leunasalpeter treated trees made as good growth as with the usual fertilizer.

In the potato experiment at Hastings doubling the amount of potash did not increase the yield nor improve the grade. Muriate proved as good a source of potash as sulfate.

The value of manganese as a soil amendment in tomato growing was shown in a series of cooperative tests. Wood ashes and calcium hydroxide gave some increase in yield when used as supplements to the regular fertilizer. The results of analyses of about 150 samples of fruit and vegetables collected in various localities indicated that Florida-grown produce contains as much iodine as that grown elsewhere.

All citrus hybrids with *Poncirus trifoliata* as one parent exhibited hardiness, withstanding 15° F. with no apparent injury. However, with the exception of the citrangequat these hybrids did not yield edible fruits. Citrange seedlings, because of their cold resistance and vigor, are deemed of value as rootstocks. A hybrid known as citrangума was conspicuous because of its willowy growth, absence of thorns, and large fruit.

Measurements of Pineapple oranges showed no relation between their size and their position on the tree. Apparently small-sized fruits were more variable both in diameter and volume than were large fruits. The actual growth of fruits, as indicated by volume, continued for from two to three months after the curves of the diameters indicated a virtual cessation of growth.

For germination of grapefruit seed a soil temperature of 32° C. (89.6° F.) was found optimum, with 37° a maximum. Sour orange apparently had an

optimum around 35 to 36°, with a maximum at 38 to 39°. Sweet orange conformed closely to grapefruit, while rough lemon reacted like the sour orange. Measurements of seedlings indicated that other factors than soil temperature controlled growth over most of the range.

Work with the refractometer method of determining oil content of avocados failed to give as reliable results as the standard ether extraction method. It was found that the percentage of fat (green basis) in the fruit increased considerably with maturity, while the water content diminished. On a dry basis no such decided increase in fat was noted. Avocados grown in Highlands County had a much higher percentage of fat and a much lower percentage of water than those grown in south Dade County. Varietal and cultural notes are presented on pears, avocados, jujubes, figs, blackberries, and grapes.

In cooperative pecan tests cover crops benefited the trees, apparently aiding in forcing into growth the twigs of bearing trees. *Crotalaria spectabilis* produced more than 21,000 lbs. of green material per acre. Analysis of the results of cooperative pecan fertilizer tests suggested that total production and growth of trees has been generally greater on the fertilized areas.

Yields of tung-oil trees subjected to different fertilizer treatments are presented in tabular form and show the greatest increase in yield and growth on plats receiving a complete fertilizer. Production continued to increase with the development of the tree. Trees with cluster type fruits outyielded on the average trees with single fruits, although the largest producer was of the latter class.

Studies with mulch paper showed beneficial results with some crops, neutral results with others, and harmful results with still others. Soil temperature under paper fluctuated less than in unmulched areas. Soil moisture and available soil nitrogen were greater under the paper.

Experiments at the Citrus Experiment Station, Lake Alfred, showed the Crotalaria species to be very valuable cover crops. Of rootstocks for citrus the rough lemon yielded the largest nursery trees, followed in order by sweet seedling, Cleopatra mandarin, and sour orange. Trees on Cleopatra mandarin tended to form denser heads than those on sweet orange or rough lemon. The Rusk citrange proved to be an outstanding citrus stock. Of three types of cultivation practiced in an orchard set in 1925, namely, none, moderate, and intensive, all three gave excellent results.

[Horticulture at the Wisconsin Station] (*Wisconsin Sta. Bul. 420 (1931), pp. 35, 36, 41, 42, fig. 1*).—Information is again presented by Renard on the origin and nature of rogues in canning peas (E. S. R., 64, p. 739). Studies by F. L. Musbach at the Marshfield Substation showed that complete fertilizer mixtures containing 8 per cent of potash applied at the rate of 400 lbs. per acre not only gave the highest yields of canning peas but also produced the highest quality, based on sifting sizes, and the best flavor and texture as shown in score card tests. On heavy loam soils of central Wisconsin maximum yields and highest quality were obtained with fertilizer mixtures containing 2 per cent of nitrogen, 14 to 16 per cent of phosphoric acid, and 6 to 8 per cent of potash. At Marshfield 400 lbs. of 2-16-8 mixture gave increased yields, returning as much as $20 per acre above fertilizer costs.

1929 paper mulch results at Marietta, R. Magruder (*Ohio Sta. Bimo. Bul. 150 (1931), pp. 101–105, fig. 1*).—Comparisons between paper mulch and cultivation as methods of soil management for vegetables showed the paper to increase the early yields of cabbage, cucumbers, sweet corn, and peppers and to decrease the early yield of tomatoes. Only with the cucumber and cabbage were the gains from paper sufficient to justify its use.

California clingstone peaches are unsuitable here, S. Johnston (*Michigan Sta. Quart. Bul., 13 (1931), No. 3, pp. 131, 132*).—In response to a request of growers a number of clingstone peaches, namely, Phillips, Tuscan, Paloro, Johnson, Peak, Orange, Albright, McDevitt, Sims, Levi, Florence, Sellers, Yellow Swan, and Hansen were tested at the South Haven Substation in cooperation with a preserving company and found wanting in respect to production and other desirable characteristics. Johnson was quite productive but yielded an unsatisfactory canned product.

Relative effect on peaches of nitrogen derived from different fertilizer sources, J. E. Vaile, C. A. McCue, and L. R. Detjen (*Delaware Sta. Bul. 167 (1930), p. 32*).—The statement in the original abstract (E. S. R., 64, p. 630) that a mixture of "nitrate of soda and dried blood" was very effective, should have read "nitrate of soda and ammonium sulfate."

Blueberry culture, C. S. Beckwith and S. Coville (*New Jersey Stas. Circ. 229 (1931), pp. 28, figs. 21*).—A third and revised edition (E. S. R., 57, p. 536) of an informational circular dealing with culture, varieties, pruning, propagation, harvesting, etc.

Moore Early grape not recommended for Michigan, N. L. Partridge (*Michigan Sta. Quart. Bul., 13 (1931), No. 3, pp. 130, 131*).—Pruning studies with the Moore Early grape showed unsatisfactory yields with all three types of pruning tested, namely, 60, 40, and 30 buds left per vine. Light pruning gave the largest yields, 2 tons in 1929, but decidedly reduced the vigor of growth which had previously been shown (E. S. R., 58, p. 237) to be closely correlated with production.

Avocado culture in Porto Rico [trans. title], P. González Ríos and A. Mayoral Reinat (*Porto Rico Dept. Agr. and Labor Sta. Circ. 93 (1931), Spanish ed., pp. 34, figs. 10*).—General information is presented on soil and climatic adaptation, races and varieties, propagation, methods of planting, general culture, control of insects and diseases, etc.

Experiments with hedges, F. A. Waugh (*Massachusetts Sta. Bul. 272 (1931), pp. 23, figs. 26*).—Beginning with a general discussion of planting, pruning, and maintenance of hedges, specific information is presented on a large number of plants, some rather unusual, which were tested as hedge materials.

FORESTRY

***A study of natural reproduction in Vermont forests.*—I, The effect of thinning on diameter growth,** G. P. Burns and W. E. White (*Vermont Sta. Bul. 311 (1930), pp. 62, figs. 27*).—Measurements and observations taken on sample plats laid out in a white pine forest near Burlington, a white birch stand with red spruce undergrowth and a pure red spruce stand, both near Plainfield, a red spruce stand near Townshend, and in a mixed hardwood stand near West Rutland and Proctorsville emphasized the extreme variability in diameter growth of individual trees of a single species, as well as between those of different species when all were growing on a small, apparently homogeneous site. Little uniformity was found in the increment of neighboring trees in the same diameter class, whether on thinned or control plats. Variability of site conditions was evidently large, even on extremely small areas.

Evidence was also seen that the distribution of species occurring in the mixed forest is not always the most effective combination; for instance, observations on a few scattering white pines in a nearby pure red spruce stand suggested that the white pine was the more effective lumber producer.

Judicious thinning of the existing forest is deemed a satisfactory substitute for the even spacing given trees in plantations. Genetic differences in seedlings are conceded to play a rôle in lumber production, bearing out the need of careful selection of seed for establishing plantations. Not all sections of the State are adapted to lumber production because of the extremely slow rate of growth of the trees, but even these areas should be planted for their influence on the recreational resources of the State.

Thinning forest plantations promotes growth, R. H. WESTVELD (*Michigan Sta. Quart. Bul., 13 (1931), No. 3, pp. 134–136*).—Some of the objectives and results of thinning forest plantations are briefly discussed. Good results were attained in an 18-year-old western yellow pine planting by removing 24 per cent of the trees representing 12 per cent of the total volume. A yield of 2.5 cords per acre was obtained in the thinning. A yield of 8 cords was obtained in thinning a Norway pine planting 21 years of age.

Forest plantation succeeds in quack grass, P. W. ROBBINS (*Michigan Sta. Quart. Bul., 13 (1931), No. 3, p. 109*).—Plantings of 2-year Norway spruce seedlings in a light sandy soil at the Dunbar Forest Experiment Station showed 64.46 per cent survival at the close of the second year, despite competing quack grass which by the middle of the second season was dense enough to hide the seedlings.

[Slash disposal in Wisconsin] (*Wisconsin Sta. Bul. 420 (1931), pp. 50, 51, fig. 1*).—An investigation carried on in cooperation with the U. S. D. A. Lake States Forest Experiment Station showed that ordinary slashings remain a fire hazard for from 6 to 8 years. Once ignited, slashings produced fires difficult to control.

Manufacture of dimension stock from northern hardwoods, A. O. BENSON (*U. S. Dept. Agr. Circ. 163 (1931), pp. 62, figs. 27*).—The purpose of this circular is to provide information on the manufacture of dimension stock from material now unutilized in lumber production. The results presented "are based primarily on studies made at typical lumber plants manufacturing dimension stock and represent the best current methods of operation and cost accounting."

Ohio Forest News, [May, 1931] (*Ohio Forest News [Ohio Sta.], No. 13 (1931), pp. 8, figs. 3*).—As in the preceding number (E. S. R., 64, p. 742), herein are contained brief comments on forest and farm woodlot plantings and club, school, and other forest activities.

DISEASES OF PLANTS

Botany and plant pathology [at the Alabama Station] (*Alabama Sta. Rpt. 1930, pp. 29, 30*).—Concerning investigations with the chlorophyll-decomposing enzyme found in the rinds of Satsuma oranges, W. A. Gardner reports that attempts to precipitate the enzyme by means of alcohol, ether, and acetone and to adsorb it by means of kaolin have been unsuccessful. On the other hand, the enzyme was readily absorbed by 2 gm. of alumina cream or of dialyzed iron to 100 cc. of orange rind juice. The enzyme is water soluble rather than oil soluble. Aqueous extracts of green rinds were less acid than those of yellow rinds, but both tended to become more acid during storage.

Studies by Gardner of the resistance of sweetpotatoes to black rot showed much difference between varieties and between strains within a variety. Some roots exhibited almost complete immunity.

Two species of Ascochyta, namely, *A. pisi* and *A. pinnodella*, were found by J. L. Seal in pea and vetch fields, the former confined chiefly to aboveground portions and the latter to the underground portions. The organisms readily attack species and varieties of Pisum, Lathyrus, Vicia, and Vigna. Locally-

grown seed of vetches and peas was found to be frequently heavily infected, much more so than that brought in from the semiarid West.

The Mycosphaerella disease of peas and vetches was observed on a wide range of hosts, such as Vicia, Pisum, Lathyrus, Cicer, Vigna, Lupinus, Medicago, Trifolium, Melilotus, and Lespedeza. The organism produced an asexual stage on living plants and a sexual stage on dead tissues. The disease is seed borne, local seed showing a high percentage of infection as compared with that introduced from semiarid regions.

Attempts to identify a new disease on hairy vetch, which caused the plants to become stunted and yellow to reddish in color, were fruitless.

[Plant pathology at the Florida Station] (*Florida Sta. Rpt. 1930, pp. 56, 92–107, fig. 1*).—Analyses of the leaves and twigs of die-back and normal citrus leaves indicated that this trouble is definitely associated with the nitrogen metabolism of the plants.

Attempts to control bark diseases of citrus trees by scraping and disinfecting the affected areas were successful in the case of infections of relatively recent origin, while lesions of several years' standing were very difficult and often impossible to cure. In the case of psorosis, especially on tangerine trees, the disease was observed to break out at other points even when the lesions were carefully treated. Observations on the bark scaling and exfoliation of the superficial corky layers on the scraped areas showed consistent differences in the reactions of grapefruit, orange, and tangerine trees. The bark scaling was thickest and exfoliation slowest on grapefruit trees and the scaling thinnest and exfoliation most rapid on the tangerine trees.

Observations by D. G. A. Kelbert on the control of melanose in a commercial citrus orchard at Palmetto are presented, but with no controls for comparison no conclusions are drawn.

Citrus canker studies showed that a saturated solution of potassium permanganate used in a strength of 1–100 would kill cultures of *Phytomonas citri* in 2.5 minutes, while a 1–1,000 solution did not kill in 25 minutes. In sterilized sandy soil which had been inoculated with *P. citri*, potassium permanganate in quantities of 1 part of saturated solution to 50 parts of soil moisture failed to kill the organism in 18 days. Under the same conditions, acetic acid added in quantities of 1 part of molar solution to 4 parts of soil moisture killed the organisms in 24 hours, but in strengths of 3–80 did not kill in 14 days. Formaldehyde added in quantities of 1 part of commercial strength to 160 parts of soil moisture killed *P. citri* in 24 hours. Of 61 different forms of Rutaceae inoculated with *P. citri*, all developed lesions. *P. citri* lived 150 days, but not 200 days, in sterile muck soil, and from potato broth cultures dried on glass survived for 27 days. Obtained directly from the host plant tissue and dried on glass it lived for 121 days, but its pathogenicity was impaired slightly after 30 days. *P. citri* in the host plant tissue as for herbarium specimens dried on glass lived for 15 days, but was dead within 30 days. Certain nonrutaceous plants were found to harbor the organism for some time, although no lesions appeared.

Citrus blight or chronic wilt, deemed a soil moisture trouble, was not transferred by buddings taken from typically blighted trees.

Studies of the diseases of citrus aphids showed *Empusa fresenii* to overwinter in two ways, (1) by the development of the zygospores during October and November, and (2) by living over the winter in the active stage in colonies of aphids. Spring activity was associated with the abundance of the overwintering materials and the activity of the aphids. Epidemic killings of the aphids on citrus are to be expected only with the remigration of these insects, a movement induced by scarcity of food. Contact insecticides in the control

may very well be limited to March or early April. Intercropping citrus with melons is advised as an aid in natural control, especially in young orchards. In the old orchards care in handling water sprouts in the fall and winter aids in conserving the resting spore stage of the fungus.

Observations on the control of citrus scab on sour orange trees at Gainesville showed no benefit from three applications of Cal-mo-sul.

For the control of downy mildew of cucurbits, copper fungicides gave much better results than sulfur, which was in fact no better than the controls. Copper dusts gave as good control as did copper sprays in most cases.

Studies on the control of nailhead spot of the tomato yielded little information on account of the general scarcity of the trouble, due apparently to the use of the resistant Marglobe variety.

Preliminary observations on a fungus disease of the tomato (*Stemphylium solani* n. sp.) indicated that control will be difficult even with thorough spraying with copper fungicides.

Observations on the strawberry disease known as French bud, crimps, or briar bud suggested that the disease is spread by the use of infected plants. An average of 63 per cent of 210 healthy plants inoculated with nematodes from crimped plants developed the disease as compared with none for the checks. The incubation period ranged from 16 to 56 days, depending on external conditions. *Aphis forbesi* and *Capitophorus fragaefolii*, transferred from diseased plants to 50 healthy plants, did not produce the disease. The nematodes were found in the spaces in the folds of the leaves, in the bud, and in the protected spaces in the axils of the younger leaves but not within the tissues of the bud. Suspended in water, nematodes, *Aphelenchus fragariae*, were killed by a temperature of 48° C. for 20 minutes or 47° for 30 minutes. Strawberry plants immersed for 20 minutes in water at 48° subsequently developed healthy foliage. Nursery plants if set out on nematode-free soil can be transferred in the autumn to infested soil without much hazard. Roguing is desirable. Adequate drainage lessened the spread of crimps from plant to plant.

The spindle tuber disease of potatoes was found to be transferred by the cutting knife and other mechanical means, but since seed growing is not a factor in Florida, such transmission is not deemed serious. Late blight (*Phytophthora infestans*) was observed about the middle of March and caused heavy losses. Bacterial wilt (*Bacterium solanacearum*) caused serious losses in some sections.

Resistance to *Physoderma zeae-maydis*, a disease of corn, was found inheritable in observations upon selfed lines. Hypodermic injection of a sporangial suspension of the organism into the apical bud tissue resulted in greater infection than was produced by simply pouring the inoculum into the tops. The incubation period varied from 11 to 25 days on inoculated plants in the greenhouse. Infection did not develop when the minimum temperature was below 68° F. Sporangia retained their viability and power to cause disease when overwintered in soil and diseased plant material, and in bottles in the laboratory.

Diplodia zeae, *D. macrospora*, and *D. frumenti* ranked in order as causes of Diplodia ear and stalk rots of corn, the first two causing gray ear molds and the last a dark brown mold. The three organisms were distinguishable on the basis of spore size, shape, and color. *D. frumenti*, *D. natalensis*, *D. gossypina*, and *D. tubericola* not only cause rots on corn and sweetpotatoes but also on cotton bolls, watermelons, and the stems and branches of tung oil, avocado, rose, poinsettia, geranium, and peach. *D. frumenti* and *D. macrospora* gain entrance to ears through exposed tips, wounds, and by growing into them at

the butt ends. Both fungi overwinter in old plant débris, in the soil, and as dormant mycelium in the seed. Tests of certain seed disinfectants for corn indicated that the use of selected clean seed gave better results as to Fusarium infection than did the treating of diseased stocks.

Pecan scab (*Cladosporium effusum*) was very abundant on susceptible varieties and caused much injury before growers could spray or dust. *Cercospora fusca*, *Cercosporella caryigenum*, *Mycosphaerella dendroides*, and *Phyllosticta caryae* caused leaf injury to pecans, and rosette caused considerable damage.

Asparagus plumosus was found to suffer from a rust disease.

Of a total of 104 different varieties and strains of watermelons and citrons planted on land badly infested with Fusarium wilt, a few showed freedom from the disease. Anthracnose, gummy-stem blight, Macrosporium leaf spot, Diplodia, and nematodes were found in the experimental watermelon fields but caused only slight damage.

[Plant pathology at the Wisconsin Station] (*Wisconsin Sta. Bul. 420 (1931), pp. 18–31, figs. 4*).—Stating that the summer of 1930 because of abnormal drought was not favorable to the development of apple scab and incidentally the result of control experiments, G. W. Keitt and D. H. Palmiter report that valuable information was accumulated on spray injury. Considerable yellowing and dropping of leaves followed applications of 1–40 liquid lime sulfur on certain days. At the same time more dilute applications (1–60, 1–80, and 1–100) caused no perceptible harm, suggesting the advisability of using weaker solutions for summer sprays. Promising results were secured in spraying apple trees in the postharvest period for the reduction of ascospores on leaves.

Greenhouse experiments conducted by Keitt, J. M. Hamilton, and R. O. Magie with various sulfur fungicides showed all to give excellent control of apple scab if applied shortly before the infection period began. If treated trees were washed (simulation of rain) after spraying, many differences were found between the materials. Dusts and wettable sulfur preparations broke down after little washing, whereas lime sulfur 1–40, with or without lead arsenate, remained effective much longer. Similar observations were made in the orchard. Lime sulfur 1–40 plus arsenate of lead 1–50 gave good control even if applied from 30 to 70 hours after inoculation, whereas dusts and wettable sulfur were much less effective. In applications made soon after infection lime sulfur controlled scab satisfactorily at temperatures ranging from 42.8 to 78.8° F. The addition of potassium permanganate to sulfur did not materially increase its fungicidal efficiency.

Studies by A. J. Riker, Keitt, W. M. Banfield, and E. M. Hildebrand showed that wrapping the union of apple grafts with tape instead of raffia or twine reduced the percentage of knotted unions and also the degree of knotting.

Riker and Hildebrand, working at Topeka, Kans., found that the malformations due to crown gall, hairy root, and other causes developed most rapidly during hot weather.

Inoculations by Riker and associates under sterile conditions showed definit differences between crown gall, hairy root, and callus overgrowths. Th pathogenes apparently gain entrance through wounds but not readily throug callus tissue. The tape served to delay temporarily the entrance of pathogene It is believed that insects feeding on the graft callus and roots afford an oppo tunity for pathogenes to enter, but no organisms were found in insects. Th bacteria were able to live over winter in the soil.

Riker and Banfield, working on the crown gall of red raspberries, found th infection occurs with about equal frequency for all months throughout th ... that infection occurs on all underground parts irrespective

the stage of growth, that infection is practically limited to the underground parts, and that infection occurs most abundantly on roots in the upper 3 in. of soil. Injured Latham roots remained susceptible for 6 weeks. Infection is usually manifested within 12 days. Root-chewing insects apparently open the way for crown gall infection, since plants protected from insects and uninjured in planting did not become infected, whereas 80 per cent of comparable unprotected plants did.

J. G. Dickson, P. E. Hoppe, and R. G. Shands, working on the development of barley resistant to scab (*Gibberella saubinetii*), found, under a system of cage inoculations, evidence that varieties differ in their resistance. However, none of the varieties tested showed anything like the resistance displayed by wheats. In field experiments some resistance to scab was noted, corroborating the cage tests.

Continuing the work in the development of yellows-resistant cabbages, J. C. Walker and L. M. Blank report substantial progress.

H. L. Blood and Walker, working on a relatively new disease of the tomato, bacterial canker (*Aplanobacter michiganense*), report that the bacteria occur both on the surface and within the tomato seed coat and are able to overwinter in the soil. The cardinal temperatures for the development of the parasite were minimum from 33.8 to 35.6° F., optimum from 75.2 to 77°, and maximum from 96.8 to 98.6°, corresponding closely with those of the tomato itself. The disease may develop at any stage in the plant's life. It is not known that the bacteria have any other host than the tomato.

Tuber index work with potatoes conducted by J. G. Milward, J. W. Brann, and J. Johnson was successful in greatly increasing the stocks of potatoes approximately free from mosaic.

Report of plant diseases inspector for year ending 31st May, 1928, D. R. D. Wiles (*Barbados Dept. Agr. Rpt. 1927–28, pp. 16–19*).—The systematic inspection indicated on page 446 showed that 16 districts of St. Michael harbored sugarcane mosaic, some being very heavily infected. Work in this connection is indicated in some detail.

Plant pathology in Germany [trans. title], M. Hollrung (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1216–1223*).—Systems of plant pathology were furnished by Zwinger, 1708; Eysfarth, 1723; Zallinger, 1779; and Batsch, 1787. Significant developments since 1797 are outlined.

Report of the imperial mycologist, W. McRae (*Agr. Research Inst., Pusa. Sci. Rpts. 1928–29, pp. 51–66*).—This portion of the report, following up work previously noted (E. S. R., 64, p. 230), deals with rahar (*Cajanus indicus*) wilt (*Fusarium vasinfectum*); sugarcane mosaic; piper betel wilt (*Rhizoctonia solani* and *Phytophthora* sp. found); *Cinchona ledgeriana* pink disease (*Corticium salmonicolor*), seedling disease (*Phytophthora* sp. ?), and bleeding disease; gram Mystrosporium blight, and wilt (*Fusarium* sp.); *Sesamum indicum* malformation and proliferation (*Macrophomina phaseoli*, not *Sclerotium bataticolum*); kodra smut (*Sorosporium paspali*); wheat leaf spot (*Helminthosporium sativum*) and rust; and maize (*Zea mays*) smut (*Ustilago zeae*).

Work of the division of pathology, A. F. Bell (*Queensland Bur. Sugar Expt. Stas. Ann. Rpt., 29 (1928–29), pp. 34–37*).—Plant-disease surveys are indicated as made in the districts of Giru, Lower Burdekin, Proserpine, Farleigh, Pleystowe, Sarina, Bundberg, Maryborough, Bauple, and Moreton, and brief details are presented regarding sugarcane gumming disease and varietal resistance thereto, Fiji disease, mosaic, sour rot, top rot, spindle top, and miscellaneous diseases.

As a result of inoculation series tests with P. O. J. 2878 and other varieties carried out by D. S. North, it has been found that strains of *Fusarium monili-*

forme capable of causing Fusarium pokkah boeng were present in Australia before the introduction of P. O. J. 2878 from Java. Stem gall disease occurred scantily on Badila in the Sarina District. A brownish stool basal rot (*Corticium* sp.) was occasionally reported, in each case from land where tree stumps were still standing and presumably the source of infection. A white streak suggesting leaf scald which was frequently found was unsupported by other symptoms.

Essential factors in destructive plant disease development, L. R. Jones (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1284–1298, fig. 1*).—Features, factors, and conditions are evaluated, including the occurrence and dissemination of the pathogene, the nature and characteristics of the organism, host infection, and subsequent development. More particularly, a review is given of Wisconsin studies of the epidemiology and control of apple scab to illustrate the methods as well as the general desirability of a more adequate understanding of the development and control of plant diseases, and inquiring into the extent, causes, and effects of their variability and other purposes and needs indicated.

"These problems, which can be met only by restudying each of our major diseases, are believed to constitute one of the most important present-day challenges in plant pathology."

Physiologic specialization in pathogenic fungi, E. C. Stakman (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1312–1330*).—The author attempts to show the significance of the phenomenon of physiologic specialization of pathogenic fungi in plant pathology, and he gives references to a considerable body of the most pertinent literature.

Some observations on the spore discharge of the higher fungi, A. H. R. Buller (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1627, 1628*).—This is an abstract, dealing specifically with the drop-discharge mechanism in the Basidiomycetes and with the discharge of spores in the Discomycetes and the phenomenon of puffing.

Some remarks on the physiological aspects of parasitism, J. C. Walker (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1263–1270*).—Recognizing as at present ample for the general field of knowledge regarding plant parasitic relationships the comprehensive résumé furnished by Blackman (E. S. R., 54, p. 448), the author undertakes to discuss a few specific cases, considering some results which have been secured in the case, for example, of certain onion storage rots, cabbage yellows, and the reaction of tobacco to the invasion of *Thielavia basicola*.

"The ever-growing importance of a better understanding of the basis o[f] differences in susceptibility and resistance among varieties of a given specie[s] probably does more than any one thing to stimulate our interest in question[s] relating to parasitism. The diseases discussed serve to illustrate the intricacie[s] involved."

The influence of sodium arsenite, sodium carbonate, and formaldehyd[e] on the conidia of Erysiphaceae, Z. Zweigbaumówna (*Internatl. Cong. Plan[t] Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1331–1333*).—Giving in tabular forr[m] with brief discussion the results of laboratory experiments with conidial spore[s] of *Erysiphe polygoni*, *Sphaerotheca pannosa*, *S. humuli*, *Oidium quercinum* and *O. evonymi japonicae*, the author states that the germinative power of t[he] conidia is highly variable and dependent upon the degree of maturity of t[he] conidia, the period of germination, and atmospheric conditions. "More th[an] once the percentage of conidia which germinated even in water was small, whi[le] solutions of arsenical compounds had an inciting effect. The approach of t[he] period during which the perithecium is being formed lessens the germinati[ve]

power, as their vegetation ends then. Tests with conidia of *O. quercinum*, which, in Poland, do not reach the stage of forming ascus strains have confirmed this, as these germinate even at an advanced moment of their vegetation period. The number of germinating conidia in a drop of liquid depends also on their distribution within the drop; for instance, conidia gathered in groups show a better germination power than single specimens."

The nature of mosaic diseases, B. M. Duggar (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1231–1242*).—Disclaiming finality as to the nature of the agency producing mosaic diseases, the author reviews groups of observations seeming to constitute important links in the chain of evidence.

"Sooner or later we must more frequently ask what, if any, are the various connecting links between complex organic compounds and the simplest known living organisms. Surely it is not possible to conceive of bacteria or protozoa as the kinds of living things that would emerge directly from a colloidal nitrogenous matrix. The elaborate correlations existing in the cell as we now know it are stupendous, and it would seem that there must be some simpler life somewhere. The soil and water areas alike should offer the opportunities needed."

On scolecesomes, and on similar bodies in mosaic-diseased plants, H. Klebahn (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1243–1248, pl. 1, figs. 5*).—A disease of *Anemone nemorosa*, described in a statement previously noted (E. S. R., 9, p. 852) and now termed "Alloiophyllie" on account of subsequent studies, is dealt with in brief detail by the author.

A mosaic virus of grasses, not virulent to sugar cane, H. H. Storey (*Ann. Appl. Biol., 16 (1929), No. 4, pp. 525–532*).—Regarding studies of a mosaic disease observed in maize and in sorghum in the Transvaal, the symptoms of which were not distinguishable from those of the common sugarcane mosaic virus, the author reports leaf-cage experiments said to show that *Aphis maidis* can transmit the virus to maize. In the part of the Transvaal where the mosaic was found all sugarcane seen was free from mosaic and failed to contract this disease. The method employed in the Natal experiments succeeded invariably in transmitting mosaic to sugarcane from diseased cane or diseased grasses from the neighborhood. It is concluded that the Transvaal virus is not virulent to sugarcane and is therefore different from the common sugarcane mosaic virus.

The effectiveness of rhizobia as influenced by passage through the host plant, O. N. Allen and I. L. Baldwin (*Wisconsin Sta. Research Bul. 106 (1931), pp. 56, pls. 10, figs. 7*).—Strains of *Rhizobium trifolii*, *R. leguminosarum*, and *R. japonicum*, differing markedly in their ability to fix nitrogen, were repeatedly passed through *Trifolium pratense*, *Pisum sativum*, and *Soja max*, with the result that definite and pronounced changes occurred in their effectiveness. In general, good strains became less effective and poor strains more effective. In some instances the strains showed a complete reversal. No direct correlation was observed between effectiveness and the number of plant passages. With *R. trifolii* evidence was obtained that these changes are cyclic, notably a reduction in effectiveness of good strains followed by a restoration on further passage. Such changes were not accompanied by any outward changes in laboratory cultures.

The ability of an organism to induce nodule formation and its ability to aid the plant when within the nodules were found to be distinct factors. Certain strains appeared equally effective on all hosts upon which they could induce nodule formation, while others were effective on one host and ineffective on others. No correlation was established between the age of the host plant from which nodules were taken and the changes which had occurred in effectiveness. The effectiveness of bacteria was apparently changed by fewer plant

passages during the spring and early summer, a condition perhaps related to carbohydrate metabolism. The effectiveness of the organism could not be associated with any definite morphological status at the time of inoculation.

Bacteria apparently exerted both a stimulatory and an inhibitory effect on the plant. Bacteria were most effective when inducing the formation of relatively few large nodules on or near the top of the primary root and conversely ineffective when inducing the formation of many small and widely distributed nodules. In the presence of adequate soil nitrogen nodule formation was lessened. Apparently, in effective strains a few nodules supply sufficient nitrogen.

The relation of the findings to the development of highly effective strains is discussed, and a comprehensive review of the literature is appended.

Studies on Rhizoctonia crocorum (Pers.) DC. and Helicobasidium purpureum (Tul.) Pat., W. Buddin and E. M. Wakefield (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1673–1675*).—The authors record the occurrence in three widely separated localities, and on three different host plants, of *H. purpureum* in close association with root rot having the characters of attack of *R. crocorum*. Other evidence including experimental results, eight of these positive but many negative, as regards the identity of these two fungus forms is given.

"It seems possible that the fungus is in a plastic state, and that its pathogenicity, as well as macroscopic appearance, may be subject to saltation."

Present evolutionary tendencies and the origin of life cycles in rusts, H. S. Jackson (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1746–1750*).—Both typical and exceptional forms and changes that have been studied in the life histories of rusts are brought together in a compact preliminary abstract.

Observations during 1927–28 on the incidence of "rusts" on various selected wheat varieties, with special reference to the intensity of yellow rust, Puccinia glumarum, Eriks. and Henn., W. A. R. Dillon Weston (*Ann. Appl. Biol., 16 (1929), No. 4, pp. 533–541.*)—Observations are given on the incidence and intensity of yellow, brown, and black rust as regards selected wheat varieties. It is claimed that bunt increases varietal susceptibility to yellow rust, and it is suggested that in testing wheat varieties for resistance to *P. glumarum* the seed should be previously bunted and be regarded as truly resistant if no yellow rust then appears.

Nuclear phenomena in Puccinia triticina physiologic form XI, R. F. Allen (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1271–1278*).—During studies of cereal rusts bearing upon interaction of host and parasite, irregularities in nuclear behavior were noted to occur in wheat leaf rust, *P. triticina* physiologic race XI. These are set forth, with discussion.

"It would be interesting to know whether the aberrations in nuclear behavior observed in *P. triticina* XI are to be regarded as an expression of the need of, and an ill-defined attempt at compensation for, the excised part of the life cycle. Also whether ultimately a revised nuclear history is to be expected, such as has been achieved and is being achieved in other rusts, by means of which *P. triticina* would be rendered independent of any aecial host."

Cytological evidence bearing on the sexuality and origin of life cycles in the Uredineae, B. O. Dodge (*Internatl. Cong. Plant Sci., Ithaca, N. Y. Proc., 1926, vol. 2, pp. 1751–1766*).—The spermatia of the rusts are male sex organs, and when present indicate that the species has in it the male element of sexuality and as such functions in a secondary way. In the rusts no structure is found comparable to the procarpic branch. "Fertilization" is accomplished

in the rusts by various methods. Cell fusions, nuclear migrations, hyphal anastomoses or any of the other known methods by which the binucleate condition is attained are not sexual fusions, and the cells or nuclei involved are not sex organs or gametes. There are no cases of sexual reproduction known in the rusts.

Nuclear condition, or nuclear behavior, is not the criterion by which the gametophytic and sporophytic phases are delimited. A proper conception of the application of these terms in the red algae and rusts and a clear notion of the meaning of sexuality and sexual reproduction as contrasted with substitute processes is essential to the understanding and appreciation of life cycles in the rusts. The suggestion that the sporogenous outgrowths from the fertilized egg in the short-cycle and the long-cycle red algae, regardless of where reduction takes place, represent the morphological sporophyte and that the tetrasporophyte is merely a "Nebenfruchtform," merits consideration.

Fertilization may be accomplished by cell fusions without nuclear fusions and by nuclear fusions without cell fusions. Rust life cycles are not necessarily fixed, as a rust may go through its particular life cycle without either cell or nuclear fusions, and so far as its vegetative mycelium is concerned, may go through its cycle wholly haploid or wholly diploid. A rust may fulfill its destiny wholly uninucleate, yet still be wholly diploid, and vice versa. The rusts, higher basidiomycetes, and ascomycetes are closely related groups evolved from the red alga line, long cycle rusts being more primitive.

The mechanism of sex in Uromyces appendiculatus and U. vignae, C. F. ANDRUS (*Jour. Agr. Research* [*U. S.*], *42* (*1931*), *No. 9, pp. 559–587, figs. 11*).—Working with two forms of Uromyces, namely, *U. appendiculatus*, the bean rust, and *U. vignae*, the cowpea rust, the author observed what he believed to be a functional sexual mechanism similar to that found in the red algae but obtained no evidence of the germination or fusion of spermatia. The 2-legged basal cells, similar to those called fusion cells by former observers, were present in the aecial primordium in the uninucleate condition previous to fertilization and, therefore, are not fusion cells. The structures believed to function as trichogenous hyphae are much branched and highly septate organs having their terminus at the epidermis of the host leaf, where they project through stomata or between epidermal cells and fuse with spermatia transferred by various agencies, such as insects. Nuclei were noted passing through the cross walls of these hyphae and migrating into the fertile cells in the aecium. Where all or nearly all of the specially differentiated receptive cells in a single aecium were fertilized there was little or no budding or branching, but in case only one or a few egg cells were fertilized there was an extensive proliferation, apparently the result of nutritive fusions with unfertilized cells.

Factors important in the development of perithecia of Venturia inaequalis, E. E. WILSON (*Phytopathology, 18* (*1928*), *No. 1, pp. 145, 146*).—Studies previously reported (E. S. R., 58, p. 553) were continued for two years, emphasizing further the relationship of the time of leaf fall to the time of maturity of the ascospores the following spring. Early (September) grounding of the leaves caused the ascospores to mature earlier.

The cardinal factors in the development of perithecia are temperature and moisture. The optimal temperature for initiation was near 13° C. (55.4° F.), the optimum for maturation of ascospores being near 20°. At 4 and 7° growth of asci occurred more readily than maturation of ascospores. Below an undefined limit, dryness checked sharply the development of the perithecia, which also matured more rapidly and normally in leaves alternately wetted and dried.

All apple varieties observed produced mature perithecia in nature, but in some this occurs earlier than in others.

The type and abundance of leaf lesions apparently bore a direct relationship to the quantity of perithecia produced. No evidence appeared that perithecia were produced at points remote from lesions, or that the fungus spread to uninfected leaves and there produced perithecia.

Resistance to Fusarium wilt in garden, canning, and field peas, J. C. WALKER (*Wisconsin Sta. Research Bul. 107 (1931), pp. 15, pls. 4*).—A large number of garden, canning, and field peas were tested for resistance to Fusarium wilt by growth in a thoroughly infested soil and found to differ widely. In 243 samples of Alaska, 40, or 16 per cent, possessed no resistance, 70 per cent more were below 50 per cent resistance, and only 1 plant possessed 100 per cent resistance. Of 199 samples of Perfection tested, all contained a high percentage of susceptible plants. The data for the varieties are presented in tabular form. With varieties such as Alaska, which contain some highly resistant strains, selection is deemed promising, while with a highly susceptible variety, such as Perfection, improvement is believed to rest on hybridization followed by selection.

Correlation between the host anatomy and the degree of susceptibility for Phytophthora infestans in potato tubers, M. P. LÖHNIS (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1279–1283*).—The author has studied qualities tending supposedly to affect susceptibility in potatoes to *P. infestans*, including a resistance quality not identified and sharply localized in the cork-cambium; a lenticel difference apparently due to the presence of parenchymatous cell layers with suberized walls; and a difference attributed to eye anatomy. Of the three qualities tested, the cork-cambium resistance is most satisfactorily protective.

Sugar cane mosaic disease, C. C. SKEETE (*Barbados Dept. Agr. Rpt. 1927–28, pp. 15, 16*).—As a result of the considerable increase of mosaic disease in certain districts during the sugarcane crop of 1926 and the young cane crop of 1927 and the inadequacy of existing measures for controlling the disease, the department was provided with a chief plant diseases inspector and 10 subinspectors of sugarcane mosaic disease.

It is suggested that "in addition to diseased corn, the presence of diseased old canes in neighboring fields constitutes a source of infection to the young cane crop, and cane growers would do well to avoid the existence of diseased old canes on their land after the young cane plants have emerged from the soil."

Bacterial canker of tomato, D. G. MILBRATH and C. E. SCOTT (*Calif. Dept. Agr. Mo. Bul., 18 (1929), No. 9, pp. 476–483, figs. 5*).—Tomato bacterial canker, here reviewed as to its occurrence and effects in various States, is said to have been found in California for the first time by M. Shapovalov in 1928 in the Counties of Stanislaus and Ventura, all varieties being about equally affected. In 1929 it was found in the Counties of Stanislaus, San Joaquin, Yolo, Contra Costa, San Mateo, Santa Clara, Monterey, and Ventura, showing in a majority of the tomato fields in some sections of some of these counties. In many cases the disease is traceable back to the seed beds. This account deals with symptoms, cause (*Aplanobacter michiganense*), and control including seed treatment and rotation (three years or more) or preferably use of healthy seed and disease-free soil.

Studies of black root rot of apple, F. D. FROMME (*Phytopathology, 18 (1928), No. 1, p. 145*).—Discussion is presented regarding the occurrence of apple black root rot in Virginia and other parts of the United States and its causation of death in 28 per cent of the initial stand at 25 years of age or 42 per cent of the replant stand at 7 years of age, the trees appearing shortly [illegible] normal vigor. Stromata are found during the latter

stages. The fungus is actively parasitic on Norway maple and mahaleb cherry, and less so on certain other deciduous trees. Some progress in control has been made in the development of resistant rootstocks.

Virus diseases of black raspberries, W. H. RANKIN (*New York State Sta. Tech. Bul. 175 (1931), pp. 24*).—The following names are recommended for the six virus diseases of the raspberry, namely, leaf curl alpha type, leaf curl beta type, severe streak, mild streak, red mosaic, and yellow mosaic. The virus nature of mild mosaic is doubted. The symptoms of the several diseases as they appear on the black raspberry are described, and the results of cross-transfer studies with the two known aphid vectors are discussed.

In an experimental planting containing the varieties Plum Farmer, Cumberland, and Ohio, the author observed that red mosaic spreads very rapidly while yellow mosaic spreads slowly, due apparently to the early dwarfing and death of the infected plants. Mild streak spreads rapidly in the Ohio variety. Correlation was noted in the Plum Farmer variety between mild mosaic and red mosaic in the same plants and is considered evidence that the two are separate manifestations of the same disease. In Cumberland the necrotic symptoms were often suppressed to a point that they were scarcely detectable, a situation which is believed to have led to the conclusion that mild mosaic is a distinct disease on this variety.

Development of the citrus-scab organism, Sphaceloma fawcettii, A. E. JENKINS (*Jour. Agr. Research [U. S.], 42 (1931), No. 9, pp. 545–558, pl. 1, figs. 5*).—Information is presented on the development of conidia and conidiophores of *S. fawcettii*, the organism causing citrus scab in Florida. Observations were made on the spring and autumn growth of the leaves of the sour orange, grapefruit, Tahiti lime, and immature fruit of the grapefruit. Inoculation tests proved the pathogenicity of the fungus even after it had been grown in culture for a period of 11 years, and also showed its power to infect Cuban shaddock. Marked cultural variations were observed between strains of the causal organism, enough so as to complicate identification on the basis of gross morphological characteristics. Certain secondary fungi often found associated with citrus scab are discussed.

Nutrition and composition of the Deglet Noor palm in relation to the decline disease, A. R. C. HAAS and L. J. KLOTZ (*Hilgardia [California Sta.], 5 (1931), No. 16, pp. 511–530, figs. 5*).—Decline disease, a serious malady found especially on the Deglet Noor date, is manifested by a greatly retarded growth of stem buds, lighter green foliage, and a gradual reduction in the quality and quantity of the fruit. Attempts to control the disease by liberal fertilization with manure and fertilizer gave no results, and trials of various chemicals were also fruitless, with the exception of copper sulfate, which in the case of the one badly diseased palm so treated effected a great improvement in growth with promise of renewed fruitfulness, whereas no recovery was seen in any of the control palms.

Diseased pinnae were lower in carbohydrates, total nitrogen, potassium, and phosphorus and higher in calcium than were healthy pinnae, with no appreciable difference in sodium, magnesium, total sulfur, and total chlorine. The ash of the dry matter of date pinnae ranged from about 12 to 29 per cent. About 80 per cent of the ash was silica. From 74 to 80 per cent of the total calcium and from 87 to 99 per cent of the total potassium of the pinnae were water soluble. Date pulp dried at 70° C. contained about 1 per cent of potassium and about 0.1 per cent of calcium. Over 90 per cent of the inorganic constituents of the dry matter of date pulp was water soluble. The potassium content of the dry matter of the roots was from 3 to 4 times that of the calcium and considerably higher than that found in the pinnae or fruit. Date seedlings grown

in culture solutions were apparently uninjured by concentrations of sodium chloride below 4,000 parts per million.

The beneficial effects of the copper are not understood, that is, whether the copper acts as an essential element, as a germicide, as a toxin precipitant, or to release other elements, such as phosphorus and potassium.

The aster yellows disease, L. O. KUNKEL (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1249–1253*).—Results are briefly outlined in this preliminary report on studies during three years on aster yellows, an infectious chlorosis, serious in the United States on the China aster (*Callistephus chinensis*) and somewhat similar to potato leaf roll, beet curly top, and peach yellows. Aster yellows shows no mottling and is regarded as not due to mosaic. An incubation period is necessary to its transmittal by insects. The disease, though attacking a wide range of host plants, is very specific in its insect relationships, and has a long and definite incubation period in the carrier. It is believed that a better understanding of plant virus diseases, as regards both the practical and the scientific viewpoint, should result from further studies on their insect relationships, as they are supposedly all insect-borne diseases.

A serious elm disease in Ohio, C. MAY and O. N. LIMING (*Ohio Sta. Bimo. Bul. 150 (1931), pp. 106–112, figs. 3*).—Information is presented on the symptoms, causal organism, manner of attack and spread, probable source, and method of control of the Dutch elm disease, found in two localities in Ohio early in 1930 and caused by *Graphium ulmi*. Complete destruction of infected trees is deemed "the only safe course to follow in the present situation."

The chemical eradication of Ribes, H. R. OFFORD (*U. S. Dept. Agr., Tech. Bul. 240 (1931), pp. 24, figs. 7*).—Of a number of chemicals tested in Idaho and Montana for the destruction of *R. petiolare*, *R. lacustre*, and *R. inerme*, sodium chlorate gave the best results. Near streams where the roots were often covered with water, one application of from 10 to 50 per cent aqueous solution of sodium chlorate to the leaves and stems of *R. petiolare* killed from 96 to 100 per cent of the treated plants. *R. lacustre* and *R. inerme* showed greater resistance, but three applications of a 25 per cent solution gave from 98 to 100 per cent killed. Fish oil soap or flake glue added to the sodium chlorate solution increased its effectiveness. The best results were obtained from applications made early in the growing season during dull, cloudy weather. Under drier soil conditions satisfactory kill of *R. lacustre* and *R. inerme* was obtained by spraying the soil about the base of the plant with a sodium chlorate 25 per cent aqueous solution and an aqueous solution of sodium hydroxide 4 per cent plus sodium fluoride 5 per cent.

The effect of sodium chlorate was first shown by a slight curling of the leaves, which within a few days turned brown. Within a week all soft stem growth died, and in two weeks the older wood succumbed. Practical suggestions are made as to the method of application and avoiding the fire hazard resulting from sodium chlorate.

ECONOMIC ZOOLOGY—ENTOMOLOGY

The swallows, goatsuckers, and swifts of New Jersey, L. A. HAUSMAN (*New Jersey Stas. Bul. 520 (1931), pp. 32, figs. 34*).—Following an introductory account of swallows, goatsuckers, and swifts, the author reports upon the swallow species—the purple martin, tree swallow, barn swallow, cliff swallow, bank swallow, and rough-winged swallow, and particularly the percentage of insects, by orders, consumed by each as food. This is followed by a field key to

and field marks of the six species of native swallows; a chart of the comparative dietaries of the native swallows and one of the foods consumed; the goatsucker species, including the nighthawk and whippoorwill; and the swift species.

[**Studies of quail (bobwhite) by the Wisconsin Station**] (*Wisconsin Sta. Bul. 420 (1931), pp. 124–126, fig. 1*).—In a study by P. L. Errington in Dane, Sauk, and Columbia Counties from October, 1929, to March, 1930, approximately 1,000 quail in 60 coveys were under observation. The most important information gained from the season's studies was that every well-fed covey wintered with almost no loss from cold or predators. Those quail having a sufficiency of good food and fair cover within easy flight distance survived in excellent condition. It was found that corn is undoubtedly the most important winter food for quail, while soybeans, most of the cultivated small grains and the seed of ragweed, wild buckwheat, and tick trefoil may similarly serve as staples when available. Seed of pigeon grass (Setaria), sunflower, and hemp are relished but are usually cleaned up by late fall. It was found that the quail partake also of dried wild grapes and the seed of sorghum, hog peanut, smartweed and lamb's-quarter, and black locust beans. Other foods, less important and of questionable value, are rose hips, fruits of false Solomonseal, acorns (opened and discarded by squirrel), and the seed of catnip and other mints, flax, pigweed, campion, some mallows, evening primrose, boxelder, and soft maple. Starving birds eat large quantities of sumac and sweetclover seed and chaffy vegetable débris. They seldom die of actual starvation; their physical reserve is merely reduced until they can not meet ordinary, natural difficulties and dangers.

There is said to be but one natural winter predator likely to require drastic control measures, namely, the big bluish goshawk, whose infrequent visits from the north woods leave the coverts in his path ravaged of much desirable game. Occasionally a Cooper's hawk winters as far north as Wisconsin and does damage to quail, but such winter habits of this raptor are rare. The large soaring red-tailed hawk is common in quail areas, but he rarely gets a bobwhite unless it be one already crippled or weak from other causes. With this predator its virtues in preying upon rodents make it a valuable species. Most hawks native to Wisconsin were found in this study to be noninjurious to quail, game birds, and song birds.

[**Report of work in entomology at the Alabama Station**] (*Alabama Sta. Rpt. 1930, pp. 30–32*).—The work by J. M. Robinson and F. S. Arant on boll weevil control on Norfolk sandy loam and Houston clay plats was continued in 1929 (E. S. R., 64, p. 354). Dusting work on the Norfolk sandy loam plats gave quite different results from tests of previous years, the cotton having been replanted so that it was two weeks later than that on the surrounding plats and the infestation of these plats did not reach 10 per cent until August 10. Three applications of calcium arsenate beginning August 12 kept the infestation on these plats below 20 per cent until September 3, whereas the infestation on undusted plats had advanced to 95 per cent during the same period. The increased yield from poisoning was 46 lbs. of seed cotton per acre on both the unfertilized plat and the plat treated with 500 lbs. of fertilizer. With 1,000, 1,500, and 2,000 lbs. of fertilizer the increases from poisoning were 134, 152, and 170 lbs., respectively, of seed cotton per acre. The 6-year average increase in yield from dusting was dependent upon the time of planting, rate of fertilizer, and the percentage of infestation. The results of the experiments show that dusting is profitable if the potential yield is 0.5 bale or more per acre and if the infestation exceeds 10 per cent.

The infestation of the Houston clay plats reached 38 per cent by June 18. Three applications of dust at 4- to 11-day intervals reduced the infestation to 2 per cent and kept it below 20 per cent until July 15. A second series of 5 applications kept the infestation varying from 6 to 36 per cent until August 6; the infestation on the undusted plats had advanced to 83 per cent during the same period. Two of the 5 applications of dust (second series) were washed off by rain within 24 hours. A ninth application of dust was made August 10 to protect the young bolls. The increase in yield was 223 lbs. of seed cotton per acre. The average increase for the 6-year period was 252 lbs. of seed cotton per acre.

It was found by L. L. English that unrefined oils are more likely to cause injury to satsumas than are refined oils when applied in the late fall to trees which are frequently subjected to severe freezing, thus substantiating earlier work (E. S. R., 64, p. 354). Severe defoliation followed oil-Bordeaux combinations or Bordeaux alone when applied to trees that had been defoliated by severe winter freezing and on which there was a short growth of new foliage. The trees quickly recovered, however, from this type of injury. Under these conditions the white oil-Bordeaux combination was followed by a more severe defoliation than a straw oil-Bordeaux combination. Oil followed by lime sulfur after an interval of six weeks resulted in injury. It appears that as long as the oil remains on the foliage some burn is liable to take place if lime sulfur is applied. In an orchard extremely heavily infested with the purple scale three applications of oil were necessary for satisfactory control. An oil-Bordeaux combination proved ineffective against the red spider, oil alone giving results comparable to lime sulfur.

A method is said to have been devised for the determination of the amount of oil retained by citrus foliage. The work led to the conclusion that in general the amount of oil retained increases with viscosity. The increase is not proportional to viscosity, as the increase becomes less when the viscosity approaches 80 seconds (Saybolt at 100° F.). It was found that heavy oil residues may remain on the foliage three months or longer, and that rainfall which occurs after the sprays have dried apparently have no effect on the oil residue. There appears to be no difference between the residues resulting from the application of straw and white oils having the same physical properties. Oil emulsions appeared to prevent the ripening and normal coloring of Satsuma fruit. In general the higher the viscosity and the concentration of the oil in the spray, the more likely there is to be retardation.

Life history studies of the pecan weevil, which has proved to be potentially the most injurious pecan insect in the central portion of the State, were conducted by H. S. Swingle and are briefly reported upon. In one large pecan orchard during the last several years it has been responsible, through its feeding and laying eggs within the nuts, for a loss of over 50 per cent of the crop. The adults emerged throughout August and could be found puncturing and feeding on the immature nuts, which dropped from the trees within approximately a week after having been punctured. An average of 22.4 eggs per female were laid, none having been deposited until the kernels became firm. About 3 eggs were usually placed in each nut, although as high as 12 have been found in a nut in the field. The eggs hatched in from 7 to 9 days, with an average of 7.7 days. The larval period within the nuts varied from 15 to 117 days, the majority of the larvae emerging after about 25 days. Upon emerging the larvae entered the soil to a depth of from 3 to 6 in., where they formed a larval cell and remained in the larval stage for about a year. Some of the larvae transformed to pupae and to adults the following September.

Connecticut State entomologist, thirtieth report, 1930, W. E. BRITTON (*Connecticut State Sta. Bul. 327 (1931), pp. 451–582, pls. 20, figs. 7*).—Following a general account of the entomologist on the organization and work of the year (E. S. R., 63, p. 453), including a list of the publications of the department for 1930 and the entomological features of 1930, articles are given on the Inspection of Nurseries in 1930 (pp. 475–487) and Inspection of Imported Nursery Stock (pp. 487–490), both by Britton and M. P. Zappe; Inspection of Apiaries in 1930, by Britton (pp. 490–501); Gipsy Moth Control in Connecticut in 1930, by Britton and J. T. Ashworth (pp. 501–518); Emergence Records of the Apple Maggot, by Zappe (pp. 519, 520); and Oriental Fruit Moth Work in 1930, by P. Garman (pp. 521–525). These are followed by accounts of the Apple Leafhoppers in Connecticut (pp. 525–527) and Selection and Compatibility of Oil Sprays (pp. 527–529), both by Garman; An Outbreak of the Saddled Prominent [*Heterocampa guttivitta* Walk.] (pp. 529–532), The Catalpa Mealy Bug in Connecticut, *Pseudococcus comstocki* Kuwana (pp. 532–535), and Early Entomological Work in Connecticut (pp. 535–542), all by Britton; The Effect of Treatment for the Cabbage Maggot under Conditions of Light Infestation (pp. 542–544) and the European Pine Shoot Moth (pp. 544–546), both by R. B. Friend; An Electric Sterilizer for Killing Insects in Milled Cereals, by Garman (pp. 546, 547); Spread of the Satin Moth (*Stilpnotia salicis* Linn.), by Britton (pp. 547, 548); The Japanese Beetle in Connecticut in 1930, by Britton and J. P. Johnson (pp. 548–553); The Asiatic Beetle in Connecticut in 1930, by Britton (pp. 553–557); Measures for the Control of the European Corn Borer, by Britton and Zappe (pp. 557–564); New Regulations regarding the Stopping of Motor Vehicles, by Britton (pp. 565, 566); and Mosquito Control in Connecticut, 1930, by R. C. Botsford (pp. 567–572).

The report concludes with a list of miscellaneous notes, including Larvae [*Meracantha contracta* Beauv.] in Rotten Stump (p. 572), Chinch Bug Injury to Lawns (p. 572), The Pandorus Sphinx [*Pholus pandorus* Hubn.] (p. 572), Thysanurids [*Achorutes manubrialis* Tull.] in Cold Frames (p. 573), Injury to Apple Trees by New York Weevil (p. 573), Aphodius Larvae in Lawn (p. 573), Curculionid Larvae [*Brachyrhinus sulcatus* Fab.] in Soil of Perennial Bed (p. 573), The Sunflower Maggot [*Straussia longipennis* Wied.] (p. 574), Mites in Greenhouses (p. 574), and Abundance of Clover Mite (pp. 574, 575), all by Britton; The Strawberry Weevil, by B. H. Walden (p. 575); A Curious Mite [*Pimeliaphilus* sp.] (p. 575) and Tropical Mite [*Tarsonemus latus* Banks] (p. 576), both by Garman; Hickory Twig Girdler, by Zappe (p. 576); Woodland Defoliated by Walking Stick (pp. 576, 577), Distribution of Mexican Bean Beetle in Connecticut (p. 577), Abundance of Oak Leaf Rollers (p. 578), and Leaf-Stalk Borer of the Norway Maple [*Nepticula sericopeza* Zell.] (p. 578), all by Britton; and Rose Stem Girdler, by Zappe (p. 579).

[Report of work in entomology at the Florida Station], J. R. WATSON (*Florida Sta. Rpt. 1930, pp. 67–73, fig. 1*).—Due to rainy weather in the spring there was no heavy infestation of thrips in citrus groves, but the tobacco thrips seriously injured narcissus plants in some fields. The Chinese lady beetle (Leis), introduced from California several years previously, was found to have become thoroughly established in a citrus grove in Orange County. In control work with the bean jassid (*Empoasca fabae*), pyrethrum sprays consistently gave greater immediate kills and showed more lasting effects than did nicotine sulfate sprays used in connection with Bordeaux mixture, with soaps, or with the new activators which are so effective against aphids.

The infestation of the green citrus aphid (*Aphis spiraecola*), which was heavier than in any year since 1925, is said to have been due to the climatic

conditions. The use of So-Fyne, Penetrol, and Grandpa's Wonder Spray as spreaders was found to kill 98 per cent or more of the green citrus aphid when used with Blackleaf 40 at dilutions as low as 1 to 10,000. The tests indicated that the pyrethrum sprays are not so consistently effective as is nicotine sulfate with spreaders.

Much damage was done in pecan groves by the nut case-bearer, as high as 60 per cent of the crop having been destroyed in some groves by the first brood of this insect. Observations by F. W. Walker of the methods of feeding of this pest show that it habitually discards the outside of the pecan nut with its coating of arsenicals when it bores into the nut. *Acrobasis juglandis*, the more frequent of the two species of case-bearers commonly found in groves, was largely responsible for the poor setting of nuts in 1930. The overwintering larvae tunnel into the unopened buds, which they often destroy. Checks made on buds from one grove showed that 92.2 per cent of the buds which failed to open had been attacked by this insect.

Experiments in the control work with the hickory shuck worm showed that plowing under the shucks in the early spring is the most effective method of control. When the pupae were buried to a depth of an inch or more in sandy loam very few emerged. The larvae, however, had to be buried at a depth of at least 4 in. in a light sandy loam or 2 in. in a heavy clay soil in order to get an 80 per cent kill or better. This emphasizes the importance of plowing the orchards after the larvae have changed into pupae in the spring.

In a study of the green spider mite (*Tetranychus bimaculatus*) on *Asparagus plumosus* J. W. Wilson found that what is probably a new biological race of this species occurs on Asparagus. This mite when taken from blackberries and other species and transferred to Asparagus promptly died, but the reverse transfer from Asparagus to blackberries was easily made. The only other host plant of this apparently new biological race is the black nightshade (*Solanum nigrum*). Derrisol and the combination of pyrethrum compounds with white oil emulsions have been found to be effective sprays for this mite.

[Report of work in entomology at the Wisconsin Station] (*Wisconsin Sta. Bul. 420 (1931), pp. 5–17, figs. 9*).—In preliminary observations of white grubs in pasture land by C. L. Fluke, K. Koch, and L. F. Graber, the factors associated with high grub population were found to include (1) location, grub territory, certain sections of the State being more affected than others; (2) susceptible crops, particularly bluegrass, timothy, and small grains; (3) a thin sod, which is intimately associated with improper pasture management, as low fertility, thin and dry soils, excessive grazing, and too early grazing; (4) well-drained soils; and (5) proximity of certain trees, particularly oaks. Of the 17 species of white grubs now known to occur in the State, only 6 or 7 are of economic importance. In a well-managed pasture a grub population of 100,000 per acre was found, in contrast with 280,000 grubs per acre in an area which had had its fertility reduced by previous cropping. Excessive grazing on a pasture resulted in an average grub count of 300,000 as compared to 100,000 in an adjoining area that had been grazed less heavily. The average of 314 counts on heavy and thick sods gave a grub count of 70,600 per acre, in contrast with an average of 205,800 grubs per acre for 269 counts on fair and poor sod.

Reference is made to work by Graber, who found through introducing white grubs into boxes of grass grown under varying conditions at a rate approximately four times that of severely infested and injured pastures that whenever unfavorable environment retarded growth of the grass or when there was low fertility or inadequate moisture the grub injury occurred much more rapidly and severely. It is thought that one of three factors may enter to explain why the grubs are less numerous in better sod, namely, (1) the beetle

may be unable to lay in thick turfs, (2) the eggs may be killed by some factor not found in a thin sod, or (3) the eggs may hatch but the grubs die off because of adverse conditions, such as inability to penetrate to the soil.

The studies by Graber have shown that grubs are conspicuously less prevalent in sweetclover fields. The average grub count in legume plats showed a decided tendency of the grubs to avoid certain varieties. The sweetclover area contained 20,000 grubs per acre, red clover 40,000 grubs, white clover 160,000 grubs, alfalfa 200,000 grubs, and bluegrass 220,000 grubs. Grub counts made in several other bluegrass areas which had been reseeded with sweetclover gave similar results. Farmers reported corn uninjured when grown on land which was in sweetclover during the year of the beetle flight, while corn grown on timothy sod near by was almost ruined.

More than 100 tests were conducted by Koch and Fluke, using various chemicals in an effort to protect corn, lawns, cemetery lots, and similar areas from grub injury, with negative results. Some of the compounds tried and found wanting were nicotine, carbon bisulfide, paradichlorobenzene, lead arsenate, calcium arsenate, zinc arsenate, mercuric chloride, kerosene emulsion, creosote, copper sulfate, and Bordeaux oil emulsion.

The cherry case bearer *Coleophora pruniella* Clem., long known to entomologists but not considered injurious to agriculture, has appeared in the State in a serious outbreak in the Door Peninsula. An oil spray made of Diamond paraffin oil which gave the best results in 1929 was recommended for use in 1930, when a survey made by A. A. Granovsky disclosed an alarmingly large number of larvae to have hibernated successfully on the bark of the small branches of the trees. Approximately 2,000 acres in Door and Kewaunee Counties were treated with the oil spray, which proved effective in controlling the pest, actual counts having shown from 80 to 98 per cent of the insects to have been killed. In a study of natural control, 142 of the 2,627 case bearers observed by Granovsky were found parasitized by species representing three groups, namely, chalcids, braconids, and ichneumonids. Light traps gave some promise, since the moths readily fly to lights placed at night in the orchard, one trap having caught over 9,000 adult case bearer moths, many of them heavy with eggs, in a single night.

A brief reference is made to control work conducted by Fluke and T. C. Allen with the apple maggot, which has recently become a limiting factor in the production of apples in certain sections of the State, particularly in the western part.

[Notes on economic insects and their control] (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 558–562*).—The contributions relating to insects of economic importance are as follows: Another Parasite [*Microbracon mellitor* Say] of the Sunflower Weevil, *Desmoris fulvus* (Lec.), by J. H. Bigger (p. 558); Reproductivity of Flies Exposed to Pyrethrum Sprays (p. 558) and A Satisfactory Nutriment for Adult Houseflies (p. 559), both by N. Tischler; Notes on the Control of the Head Louse, *Pediculus humanus capitis* DeGeer, with Benzol, by D. C. Parman (p. 559); Burying Peach Drops to Prevent the Escape of Plum Curculio Adults, by O. I. Snapp and J. R. Thomson (pp. 559, 560); *Diabrotica balteata* Lec., by A. C. Davis (p. 560); A Leafhopper [*Erythroneura plena* Beamer] Injuring Peach, by H. S. McConnell (pp. 560, 561); and Attractants for the Male Gipsy Moth, by C. W. Collins and S. F. Potts (pp. 561, 562).

An incubator room, W. A. Baker and K. D. Arbuthnot (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 444–449, pls. 2, figs. 3*).—Details are given of the construction of hygral and thermal equipment for installation in an incubator room used in the study of insects. The selection and treatment of the room are also discussed.

Developing resistance or tolerance to insect attack, E. P. Felt and S. W. Bromley (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 437–443*).—The authors call attention to the fact that "there are many peculiarities in relation to insect attacks which have not been explained. Some are undoubtedly physiological, others may have a distinct relation to the vigor or condition of the plant, as in the case of the Hessian fly (*Phytophaga destructor* Say), the lace bugs of rhododendrons and azaleas, *Stephanitis rhododendri* Horv. and *S. pyrioides* Scott, respectively. Injury is also somewhat proportionate to the size and vigor of the host, as evidenced by European corn borer (*Pyrausta nubilalis* Hubn.) infestations. Extended injuries by the elm leaf beetle (*Galerucella xanthomelaena* Schrank) are dependent in considerable measure upon favorable climatic conditions, these latter undoubtedly resulting in a less vigorous growth. A peculiar and unexplained physiological reaction by gipsy moth larvae (*Porthetria dispar* L.) is also mentioned. Evidence available indicates that a number of the cambium borers, namely, the bronze birch borer (*Agrilus anxius* Gory), the two-lined chestnut borer (*A. bilineatus* Web.), the hickory bark beetle (*Scolytus quadrispinosus* Say), and the cedar bark beetle (*Phloeosinus dentatus* Say) successfully invade trees with a lowered vitality, and that in the case of the first named it is possible to stimulate growth by feeding and aid trees to actually destroy the borers. It is suggested that a uniform and satisfactory supply of moisture throughout the season and feeding to promote a vigorous growth may be valuable preventive measures in the case of certain insects at least."

The differential between the effect of radio waves on insects and on plants, T. J. Headlee (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 427–437, figs. 3*).—In this contribution from the New Jersey Experiment Stations the author found that "electric energy propagated in an electrostatic field at the rate of from 1,000,000 to 3,000,000 cycles per second with a field strength of 4,000 volts per inch can be used to destroy certain insects inclosed in the electrostatic field without damage to their host plants. When, however, the electric energy is propagated at the rate of from 12,000,000 to 15,000,000 cycles per second with a field strength of 4,000 volts per inch both the insects and the plants are promptly destroyed. Thus there appears a differential in the effect of electromagnetic waves on insects and their host plants, and that frequency in their rate of propagation is apparently the primary selective factor."

Research in fumigation and sterilization methods (*Florida Sta. Rpt. 1930, pp. 86, 87*).—In connection with toxicity studies by R. J. Wilmot and R. L. Miller a new and original method was designed and is now in use by which insects in cotton stoppered glass tubes can be easily and quickly exposed to an atmosphere of known concentration of hydrogen cyanide gas. House flies were killed in 2 minutes and 8 seconds when the hydrogen cyanide gas, ranging in concentration from 0.34 to 0.40 per cent, was drawn over them; they were killed in 2 minutes and 45 seconds at a 50 per cent lower concentration.

Recent developments in spray residue removal, D. F. Fisher (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 526–531*).—A brief summary of information on the subject.

Protecting stored grain from insects by the use of oils, W. P. Flint (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 425–427*).—The author concludes that if an oil can be found which will not affect the feeding quality of the treated corn or other grains this method of protecting grains has very large possibilities, and may be of great value in the warmer parts of the world where stored grain insects are extremely abundant and destructive.

Control of cotton insects, A. F. CAMP (*Florida Sta. Rpt. 1930, pp. 64, 65*).—Observations on the emergence of weevils into the experimental plats at Gainesville during the spring of 1930 indicated that the destruction of stalks the preceding fall had a good influence on the emergence of the weevils, from which standpoint the results were considered very encouraging. Results with mopping supplemented by dusting after heavy squaring had started indicated that a better control would be obtained in this way than with mopping alone.

Pangaeus uhleri, a pest of spinach, G. E. GOULD (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 484–486*).—This is a contribution from the Virginia Truck Experiment Station on a burrower bug, *P. uhleri* Sign., which was observed attacking spinach as the seedlings were pushing through the ground.

Distribution of the potato leafhopper (Empoasca fabae Harris) and its close relatives of Empoasca, D. M. DELONG (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 475–479, figs. 2*).—A study of the crops which they infest and the conditions under which they occur indicates that four species of Empoasca occurring on truck crops cause economic damage and are distributed for the most part in different areas. *E. fabae* is a low altitude humid species occurring in the eastern United States. *E. filamenta* is a high altitude arid species and occurs in the intermountain region of western United States. *E. abrupta* and *E. arida* are low altitude arid species and occur on the Pacific coast in abundance.

A comparison of oviposition and nymphal development of Empoasca fabae (Harris) on different host plants, F. W. POOS and F. F. SMITH (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 361–371, pls. 2*).—This is a report of comparative tests made in 1929 and 1930 of certain forage crops and other plants to determine which plants *E. fabae* prefers for oviposition, also the number of nymphs developing to the adult stage. Potato appeared to be the preferred host plant, followed by Whippoorwill cowpea, dahlia, nonpubescent soybean, alfalfa, Stringless Green-Pod bean, Dixie soybean, and red clover, about in the order named. When varieties of red clover and soybean were tested, more nymphs of *E. fabae* hatched from the nonpubescent or appressed pubescent varieties which were used than from the rough, hairy varieties. More nymphs hatched from Hairy Peruvian alfalfa than from Kansas alfalfa, a much less pubescent variety.

An important cause of frequent failures of alfalfa, J. F. DUGGAR (*Alabama Sta. Rpt. 1930, pp. 37, 38*).—It has been found that in certain warm months from 10 to 80 per cent of the stems of alfalfa both in the Black Belt counties and at Auburn have been girdled by the three-cornered alfalfa hopper (*Stictocephala festina* Say). This has resulted in the usual symptoms of yellowing of the foliage, stunting of the growth, or death of the affected stems. In dusting experiments sodium fluosilicate seemed more effective than a nicotine preparation, sulfur, or paradichlorobenzene, resulting in a considerable reduction in the percentage of girdled plants and in the number of larvae observable at given dates thereafter. On August 9, 34 days after dusting with sodium fluosilicate, only 9 per cent of the stems were found girdled, as compared with 16 per cent on the immediately adjacent untreated plat.

The spruce gall aphid (Adelges abietis) as a nursery pest, F. L. GAMBRELL (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 355–361*).—In this contribution from the New York State Experiment Station the author reports that *A. abietis* is an important enemy of Norway spruce in New York nurseries, and that nurserymen often sustain serious economic losses due to the ravages of this insect. "There are two generations, both of which occur on spruce. No alternate host appears to be involved. Results of some treatments employed in the control of this

insect are included. Applications of miscible oils and Bordeaux lubricating oil emulsions have given good control but have been attended in some cases by injury to the trees, which varied directly with the material and the concentrations used. Likewise, promising results have been secured from the use of lime sulfur, soaps, and nicotine. No injury has been observed following applications of these latter materials."

An experiment with summer oil for the control of the European elm scale (Gossyparia ulmi L.), C. R. CLEVELAND (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 349–355*).—Studies are reported in which the application of a summer or white oil emulsion in early July to nursery grown elms heavily infested by *G. ulmi* produced highly effective control at 2 per cent concentration of the emulsion. Data relative to the influence of time and methods of application, insecticidal action of the oil, and tolerance of the trees to oil injury are presented.

Oyster shell scale causes serious losses, E. I. MCDANIEL (*Michigan Sta. Quart. Bul., 13 (1931), No. 3, pp. 112–114, fig. 1*).—A brief practical account of this orchard pest, and means for its control.

Controlling the peach tree borer, R. HUTSON (*Michigan Sta. Quart. Bul., 13 (1931), No. 3, pp. 110–112, fig. 1*).—This is a practical account in which the use of paradichlorobenzene in combating the peach borer is described.

The eradication of isolated gipsy moth outbreaks, A. F. BURGESS (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 518–525*).—A brief review is given of the methods used in eradicating isolated colonies of the gipsy moth, with information concerning a number of infested locations where eradication has been accomplished.

Seasonal-history studies on the European corn borer in Michigan, G. T. BOTTGER and V. F. KENT (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 372–379, fig. 1*).—Observations made on several hundred specimens for five consecutive seasons, both in the field and the insectary, indicate that favorable temperatures and humidity are the most influential factors in promoting normal seasonal development of the European corn borer.

Pyrausta nubilalis Hubn. handling of single-generation larvae to supply parasite data, W. A. BAKER and R. MATHES (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 404–413, fig. 1*).—The authors find that "for reducing mortalities in effecting a parasite recovery program for the European corn borer, fall collections of larvae of the single-generation strain should not be made prior to the borers entering hibernation. When collected, the borers should be placed under storage conditions favorable for dormancy. The hibernating borers should be allowed to remain under these conditions without contact moisture until the last of April. After this time they may be placed under developmental conditions with weekly applications of contact moisture."

Migration and dissemination of European corn borer larvae (Pyrausta nubilalis Hubn.), C. R. NEISWANDER and J. R. SAVAGE (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 389–393, figs. 3*).—Data are presented in this contribution from the Ohio Experiment Station which show the period, distance, and amount of larval dispersion that occurred in a series of experiments extending over a period of three years.

Some observations on the planting date of corn and its relation to European corn borer population, G. A. FICHT (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 380–386*).—This contribution from the Indiana Experiment Station reports upon some of the progress made in three seasons of study pertaining to the relation of the planting date of corn to corn borer infestations and populations (E. S. R., 65, p. 152). Other conditions being equal, greatly reduced infestations [illegible] populations were evident in the later plantings.

Correlation of corn borer survival with maturity of corn, E. G. Kelsheimer and J. B. Polivka (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 386–388*).—In this contribution from the Ohio Experiment Station data are presented which show a significant correlation between European corn borer survival and host development.

The effects of physiological change in the corn plant on corn borer survival, J. B. Polivka (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 394, 395*).—In this contribution from the Ohio Experiment Station the author points out the necessity of considering corn development in determining the true value of an insecticide used in the control of the European corn borer.

The lethal power of certain insecticides tested in Michigan against the European corn borer, F. L. Simanton, F. F. Dicke, and G. T. Bottger (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 395–404*).—This is a progress report of tests to determine the effectiveness against the European corn borer of insecticides commonly used in insect control, and also of certain promising but less known insecticides.

The European corn borer situation in the United States at the close of 1930, L. H. Worthley and E. G. Brewer (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 507–512*).—The season of 1930 in the United States is said to have been a most unfavorable one for the European corn borer, only 61 newly infested townships having been discovered in the one-generation area and 59 in the two-generation area.

A review of the European corn borer outbreak in Ontario, L. Caesar (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 512–517*).—A brief account of the outbreak of the European corn borer discovered in Ontario in 1920 and control work conducted.

A preliminary report on the Lima bean pod-borer and other legume pod-borers in Porto Rico, M. D. Leonard and A. S. Mills (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 466–473*).—The authors report upon preliminary observations on the distribution, life history, economic importance, and food plants of *Maruca testulalis* Geyer. Preliminary notes are also given on the pyralids *Etiella zinckenella* Treit. and *Fundella cistipennis* Dyar and the gelechiid *Brachyacma palpigera* Wlsm., also reared from the pods of the legumes. Preliminary notes are given on these species and their parasites, as well as on several other species of lesser importance.

Paradichlorobenzene as a fumigant for the immature stages of clothes moths, G. W. Herrick and G. H. Griswold (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 420–425*).—The authors report that "paradichlorobenzene has been used as a fumigant for the immature stages of clothes moths in a series of experiments extending over a period of several months. It was used at the rate of 12 oz. and of 16 oz. to 100 cu. ft. The gas of paradichlorobenzene proved toxic to the eggs, the larvae, and the pupae when confined in a tight box, trunk, or closet. The immature stages were usually killed if they were subjected to the gas over a sufficient period of time. In thin, cheap, garment bags the gas did not prove very effective against the larvae. In the heavier, vapor-proof paper bags the larvae were killed."

Two wild grasses as hosts of the Hessian fly, Phytophaga destructor, W. B. Noble (*Jour. Agr. Research [U. S.], 42 (1931), No. 9, pp. 589–592*).—In the rearing studies conducted the author has found that the Hessian fly is able to complete its development on both *Agropyron repens* and *Elymus canadensis*, although it does not do so as readily as in wheat. It does at times breed in these grasses in nature and may, under favorable conditions, be able to subsist on these grasses in the absence of wheat.

Anatomy of the Hessian fly larva, L. Haseman (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 417–419*).—A contribution on the anatomy of the Hessian fly larva.

A preliminary report on the effectiveness of sodium fluosilicate as compared with borax in controlling the house fly (Musca domestica Linne), S. Marcovitch and M. V. Anthony (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 490–497, fig. 1*).—In a large series of insecticide tests conducted at the Tennessee Experiment Station, borax was found superior to sodium fluosilicate in destroying fly maggots in manure. Both of these insecticides act as stomach poisons, producing mortality when treated manure is actually eaten. Sodium fluosilicate has the advantage of being much more toxic to either larvae or adults. In addition, sodium fluosilicate in amounts up to 300 lbs. per acre has no detrimental effect on plant growth, while borax in very small amounts may prove harmful to certain sensitive plants such as citrus. Since small maggots are more easily poisoned by chemical treatment than are large larvae, best results will be obtained by sprinkling the manure with a saturated solution (1–154) of sodium fluosilicate each day.

Carrot rust-fly found in Michigan, R. H. Pettit (*Michigan Sta. Quart. Bul., 13 (1931), No. 3, pp. 119–121, figs. 3*).—This European pest, discovered in Michigan for the first time at Sault Sainte Marie in June, 1914, remained inconspicuous but appeared at Alpena in 1929 and seriously injured several acres of carrots. It appeared in 1930 at Petoskey.

Grub infestation as a possible indication of crop selection by June beetles for egg laying, C. L. Fluke, jr., K. Koch, and L. F. Graber (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 450–452*).—A contribution from the Wisconsin Experiment Station in which population studies of the white grub in the State showed that there are fewer grubs in certain legumes, indicating that adult beetles are plant selective in their egg-laying habits. Data relating to this are also noted from another source on page 452.

The present status of the established parasites of Popillia japonica Newman, J. L. King (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 453–462, figs. 4*).—This is a report on accomplishments in establishing parasites of the Japanese beetle in the United States.

Observations on the wintering habits of the striped cucumber beetle, L. Haseman (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 486–490*).—A report of observations which indicate that "the adult striped cucumber beetles (*Diabrotica vittata*) feed on green cucurbit fruits and the blossoms of weeds and flowers long after the first killing frosts destroy the natural food crops. In cage experiments the beetles collect in bunches beneath green as well as dry grass and other vegetation supplied as coverage, but they do not burrow into the ground."

The wheat strawworm, Harmolita grandis Riley, in Utah, 1930, G. F. Knowlton (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 414–416, figs. 2*).—The author reports that the wheat strawworm is generally distributed throughout the irrigated and dry-farm wheat sections of northern Utah. The infestation in this area during 1930 was moderately heavy, one-third of the culms examined in the fall having been infested.

The artificial rearing and colonization of Trichogramma minutum, C. H. Alden and D. F. Farlinger (*Jour. Econ. Ent., 24 (1931), No. 2, pp. 480–483, pls. 2*).—In this paper the authors report upon the results of two years' experiments on rearing and colonizing *T. minutum* Riley on peach, apple, and pecan insects in Georgia. The Angoumois grain moth was used as the laboratory host. Field hosts are the oriental fruit moth, codling moth, nut case bearer,

leaf case bearer, and shuck worm eggs. A new type of parasite card is described. Some very promising results were obtained in the field, especially in parasitizing the eggs of the oriental fruit moth and codling moth.

ANIMAL PRODUCTION

[Animal nutrition studies in Wisconsin] (*Wisconsin Sta. Bul. 420 (1931), pp. 73–75, figs. 2*).—The results of two studies are noted.

Vitamin E is plentiful in milk.—In studies with rats J. Waddell, H. Steenbock, and E. B. Hart found that when milk fortified only with copper and iron was fed as a sole diet to rats they reproduced living young to the third generation, even though growth and reproduction were abnormal. Adding small amounts of manganese or iodine or both improved the reproductive process, but when the iron was omitted the rats suffered from chronic anemia. The subnormal reproduction was due to late sexual maturity and poor ovulation, which was apparently checked by the addition of manganese and iodine, and there was no evidence of lack of vitamin E. Whole milk furnished an adequate diet without any other food when supplemented with the above minerals.

Test new methods of feeding copper to anemic pigs.—Continuing these studies (E. S. R., 62, p. 367), Hart, Kemmerer, J. M. Fargo, and G. Bohstedt found that when pigs were fed 150 mg. of ferric sulfate and 25 mg. of copper sulfate once a week anemia was prevented. Pigs farrowed on pasture before the ground was frozen were not afflicted with anemia. Sunlight and ultraviolet light had no influence upon the level of hemoglobin in the blood of suckling pigs or upon the development of anemia.

[Experiments with beef cattle in Alabama], J. C. Grimes (*Alabama Sta. Rpt. 1930, pp. 25, 26*).—The studies previously noted (E. S. R., 64, p. 367) have been continued.

Winter feeding and time of marketing steers.—A group of 25 long-yearling steers were fed a winter ration of Johnson grass hay self-fed for 112 days, while a similar lot received Johnson grass hay self-fed plus 1.75 lbs. of cottonseed meal daily. Lot 1 lost 87 lbs. per head and lot 2 1.2 lbs. per head during the winter feeding. The animals were regrouped at the end of the winter period and divided into two lots and put on pasture. Lot 1 received 4 lbs. of cottonseed meal per head daily in addition to the pasture, while lot 2 was on pasture only. Lot 1 gained 2.46 lbs. daily during the pasture season and returned a profit above feed cost of $6.50 per head, while lot 2 made an average daily gain of 1.62 lbs. per head and returned a profit of 44 cts. per head.

Wintering stocker calves and heifers.—Records on a lot of 138 beef calves fed mixed alfalfa and Johnson grass hay, corncob-shuck meal, and cottonseed meal on pasture showed that they ate 1 lb. of concentrates and 6.27 lbs. of hay daily, gained 13.6 lbs. per head during the winter at a feed cost of $6.47 per head. Similar records on 60 yearling heifers fed Johnson grass hay and cottonseed meal on pasture showed that they received 0.79 lb. of cottonseed meal and 3.13 lbs. of hay per head daily, lost 12.3 lbs. per head during the winter period, and their feed cost was $2 per head.

[Experiments with beef cattle in Florida], A. L. Shealy (*Florida Sta. Rpt. 1930, pp. 51, 52, 53*).—The results of two studies are briefly noted.

The value of grazing for fattening cattle in beef production.—In this study 4 lots of 5 steers each were placed on pasture plats of 3.5 acres each and were grazed on the following grasses: Carpet, Bermuda, Bahia, and a plat of a mixture of carpet, Bermuda, Bahia, and Dallis grasses. The grazing period

was approximately 255 days. The average gain per steer during the season was 165, 171, 189, and 197 lbs., and the pounds of beef produced per acre were 236, 243, 270, and 280 lbs. in the respective lots.

The cost of wintering steers preparatory to summer fattening on pasture.—Continuing this study (E. S. R., 63, p. 658), a lot of 20 steers fed an average of 13 lbs. of peanut hay per head per day for 74 days lost an average of 19.25 lbs. per head. The average daily cost of the ration was 13 cts. per head.

Methods of steer feeding compared (*Wisconsin Sta. Bul. 420 (1931), p. 108, fig. 1*).—Continuing this study (E. S. R., 63, p. 58) under the same plan, J. G. Fuller, B. H. Roche, and G. Bohstedt fed 3 lots of steers for 168 days. The average gains in the respective lots were 2.79, 2.72, and 2.8 lbs. per head. The feed cost per 100 lbs. of gain was 26 cts. higher in lot 2 than in lot 1 and $1 higher in lot 3 than in lot 1. Due to a slightly higher finish, the steers in lot 3 sold somewhat higher than those in lots 1 and 2. The return per steer above feed costs was $11.61, $9.68, and $9.44 in the respective lots.

[Sheep studies in Wisconsin] (*Wisconsin Sta. Bul. 420 (1931), pp. 101–103, fig. 1*).—The results of several studies are noted.

Pea vine silage and hay for lambs.—In cooperation with a canning factory, 4 lots of 30 lambs each were fed for 61 days. Ground barley was fed to all lots and in addition the respective lots received alfalfa hay, artificially dried pea vine hay, pea vine silage, and sweet corn silage (no ears) with 0.2 lb. of linseed meal daily. The average daily gains in the respective lots were 0.45, 0.34, 0.32, and 0.26 lb. per head. The total feed cost per 100 lbs. of gain was $7.47, $8.80, $8.78, and $11.29, respectively.

Lambs, ewes on good pasture need no grain supplement.—G. Bohstedt and A. E. Darlow found that feeding lambs a grain supplement while on pasture was an uneconomical practice. Ewes and suckling lambs were put on timothy-clover pasture for 4 weeks, followed by rape pasture for 8 weeks, and the ewes gained 9.7 lbs. per head during this period. Other ewes on bluegrass pasture for 12 weeks gained 2.4 lbs. per head, while those on timothy-clover pasture for 12 weeks maintained their weight. The lambs with the ewes were fed cracked corn in creeps and gained at the rate of 0.32, 0.21, and 0.22 lb. per head daily and required 92.8, 85, and 112.7 lbs. of corn per 100 lbs. of gain in the respective lots.

Hand-feeding fattening lambs more economical than self-feeding.—In this study Bohstedt fed 3 lots of 70 lambs each. Lot 1 was hand-fed twice daily on ground barley and chopped alfalfa hay, lot 2 was self-fed the same feeds, and lot 3 was self-fed the same feeds mixed before placing in the feeder. The rate of gain was practically the same in all lots with a slightly higher grain and lower hay consumption in the self-fed lots. The cost per 100 lbs. of gain was $8.81, $9.06, and $9.17 in the respective lots.

Feeding grain to lambs for the spring market, J. C. Grimes (*Alabama Sta. Rpt. 1930, p. 26*).—A lot of 86 lambs fed for spring market on a grain mixture of ground corn, cottonseed meal, wheat bran, and salt 67:21:11:1 returned a profit above feed and marketing costs of $6.56 per head. A lot of 80 similar lambs receiving no grain returned a profit of $6.26 per head.

[Experiments with swine in Alabama], J. C. Grimes and W. E. Sewell (*Alabama Sta. Rpt. 1930, pp. 24, 25*).—The studies previously noted (E. S. R., 64, p. 370) have been continued.

Feed cost of raising pigs to weaning age.—Records covering a period of 4 years and involving 98 litters of 700 pigs showed that the average cost of raising a pig to weaning age was $3.09, that the feed cost during this period was inversely proportional to the number of pigs raised per litter, that pigs

from small litters were larger at weaning age than pigs from large litters, and that the more prolific sows were better mothers and raised a larger percentage of their pigs.

Soybean hay as a supplement to white corn and tankage for growing and fattening hogs.—The average results of two trials showed that pigs in dry lot on a ration of white corn and tankage 9:1 self-fed made an average daily gain of 1.29 lbs. per head and required 386.97 lbs. of concentrates per 100 lbs. of gain. Those on a ration of yellow corn and tankage 9:1 self-fed gained 1.48 lbs. per head daily and consumed 367.56 lbs. of feed per 100 lbs. of gain, and those on a ration of white corn and tankage 9:1 self-fed plus soybean hay gained at the rate of 1.41 lbs. per head daily and required 379 lbs. of feed per 100 lbs. of gain.

[Swine studies in Wisconsin] (*Wisconsin Sta. Bul. 420 (1931), pp. 103–105*).—The results of two studies are noted.

What is best nutritive ratio for fattening hogs?—J. M. Fargo conducted several feeding trials to compare rations with a wide nutritive ratio with rations having a narrow nutritive ratio and to compare the practice of changing the nutritive ratio three times, two times, once, and with no change during the time the pigs were increasing from 40 to 200 lbs. in weight. It was found that when a mixture of tankage, linseed meal, and chopped alfalfa was used as a supplement to corn, pigs weighing from 40 to 75 lbs. made faster but more expensive gains when receiving a nutritive ratio of 1:4.5 than when receiving a nutritive ratio of 1:5. Feeding 60-lb. pigs a ration having a ratio of 1:5 until they weighed 100 lbs. and a ration of 1:6.2 to 200 lbs. made as rapid and as economical gains as pigs started on a nutritive ratio of 1:4.5, and as the pigs took on weight widened in three changes to 1:6.5 or 7.

Pigs that make best gains also yield best carcasses.—In swine record of performance tests, Fargo and J. M. Coyner found that the fastest growing litter gained at the rate of 1.86 lbs. per head daily, while the slowest growing lot averaged 1.15 lbs. The lot making the most rapid gains required 360 lbs. of feed per 100 lbs. of gain, while the slowest lot required 485 lbs. of feed. The pigs from the lots making the fastest gains had a dressing percentage above the average, and their carcasses ranked in the top group on the basis of quality.

Market surplus wheat as pork, V. A. Freeman (*Michigan Sta. Quart. Bul., 13 (1931), No. 3, pp. 107, 108*).—In this test 2 lots of 8 pigs each, averaging 36 lbs. per head, were self-fed a protein supplement composed of 70 per cent of tankage and 30 per cent of linseed meal in dry lot with alfalfa hay for 139 days. In addition lot 1 had access to shelled corn and lot 2 to coarsely ground wheat. The average daily gains were 1.09 and 1.1 lbs. per head, and the feed requirements per 100 lbs. of gain were 375 and 408 lbs. in the respective lots. On the basis of prices charged for feed in this study, each bushel of corn fed returned $1.11 and each bushel of wheat returned $1.07.

A study on the preparation of rations as related to the growth and development of pigs, J. T. Garrido (*Philippine Agr., 19 (1930), No. 6, pp. 397–409, fig. 1*).—In this study at the University of the Philippines, a ration of corn, rice bran, copra meal, and dried shrimps 20:00:15:5 was fed to 6 lots of 6 pigs each. The first 3 lots received whole corn which was cooked, soaked for from 10 to 14 hours, or mixed with water immediately before feeding in the respective lots, while the last 3 lots received ground corn treated in the above manner. The pigs were run on pasture between feedings.

The unsoaked rations gave the best results and the cooked rations the poorest. The rations made up with whole corn produced more economical though somewhat less rapid gains than those made up with ground corn.

[Horse studies in Wisconsin] (*Wisconsin Sta. Bul. 420 (1931), pp. 105–107, fig. 1*).—The results of two studies are noted.

Corn silage approved for yearling draft foals.—A lot of 4 yearling draft foals were fed an average ration per head of 10.7 lbs. of whole oats, 2.7 lbs. of wheat bran, and 13.3 lbs. of timothy hay by J. G. Fuller, B. H. Roche, and G. Bohstedt. A similar lot received 8.4 lbs. of whole oats, 2.1 lbs. of wheat bran, 10.4 lbs. of timothy hay, and 22 lbs. of silage. The average gain was 0.88 and 0.97 lb. per head, with the daily rations costing 26 and 21 cts. in the respective lots. None of the colts showed any ill effects from the feeding of silage.

Oat feed has merit as a hay substitute.—In a feeding trial by A. W. Lathrop, O. E. Sell, and Bohstedt, 1 horse in each of 8 teams doing hard work was fed a ration of oats and timothy hay, while in the ration of the team mate unground oat feed replaced half of the timothy hay. After 10 weeks' feeding the rations were reversed, and the feeding was continued for another 10 weeks. The average loss per head while receiving oats and timothy was 54.4 lbs. and while receiving the oat feed 57.7 lbs.

[**Poultry studies in Wisconsin**] (*Wisconsin Sta. Bul. 420 (1931), pp. 79, 81, 82, 85–90, figs. 2*).—The results of several studies are noted.

Acids and sugars fail to prevent leg weakness in chicks.—White Leghorn chicks were fed a basal ration of yellow corn, skim milk, salt, and calcium carbonate with distilled water in studies by E. B. Hart, H. T. Scott, J. D. Keenan, C. E. Holmes, and J. G. Halpin. Glucose in amounts varying from 2 to 20 per cent was added to this ration replacing a like amount of corn, while hydrochloric acid was used at levels varying from 0.1 to 1 per cent. The chicks were fed for 6 or 8 weeks, then killed, and the bone ash determined. The chicks on the basal ration had an average bone ash content of 37.9 per cent, those on the basal ration plus ultra-violet light 46.8 per cent, but in no case did the use of sugar or acid influence favorably bone calcification, the ash level remaining at from 34 to 39 per cent.

Carbon arc lamps compared with quartz mercury lamps.—Studies by Keenan, Scott, Hart, Holmes, and Halpin have shown that the ultra-violet light radiated by carbon arc lamps was less intense than that from quartz mercury lamps. The ash content of chicks fed a rachitic ration was 35 per cent, those irradiated with a carbon arc lamp 42.1 per cent, with a quartz mercury lamp 45.3 per cent, and those fed 2 per cent of cod-liver oil 48.3 per cent. The composition of the carbon and the strength of the current used apparently influences the intensity of the ultra-violet light.

Nutritive value of rations affected at high temperatures.—Chicks were started when 2 days old on a ration with and without calcium carbonate, yellow corn, middlings, soybean meal, skim milk powder, and salt, fortified after heating with cod-liver oil, in studies by Hart, Scott, Holmes, and Halpin. Heating to from 140 to 149° F. did not appear to destroy the ration's ability to promote growth, but at from 208 to 212° in the presence or absence of calcium carbonate some injurious effect on the nutritive value was noted. When heated to 250° (15 lbs. steam pressure) there was a marked depressing effect on the nutritive properties of the ration.

[*Infertile eggs as a source of protein for baby chicks.*]—White Leghorn chicks were divided into 4 lots of 25 chicks each by M. O. North and Halpin and fed a basal ration of ground yellow corn, standard middlings, wheat bran, alfalfa leaf meal, dried buttermilk, meat scrap, pearl grit, salt, and cod-liver oil. The basal ration was fed to lot 1, while in lot 2 the dried buttermilk was replaced by boiled whole eggs which were found to be infertile at the first candling during incubation. Lot 3 received the basal ration plus egg yolk and lot 4 the basal ration plus egg white. At the end of 6 weeks the average weight per chick in the respective lots was 12.8, 13, 12.8, and 10.8 oz.

Comparative value of different sources of vitamin D.—Over a period of 5 years, Halpin, Holmes, and Hart have made a study of the ultra-violet light potency of winter sunshine in southern Wisconsin. During each of the 5 winters 8 lots of 30 pullets each were used, and the respective pens were housed and handled in the following manner: Glass closed, glass closed and quartz mercury lamp, glass open and quartz mercury lamp, glass open, glass substitute closed, quartz glass closed, white cloth closed, and glass closed plus cod-liver oil. The average production in the respective lots for the 5-year period was 68.7, 105.3, 99.2, 90.9, 88.5, 95.9, 80.5, and 102.9 eggs per bird. The hatchability of eggs laid during March, based on the average for 5 years, was 13, 59, 65, 45, 45, 45, 23, and 49 per cent in the respective lots. These results indicate that winter sunshine in southern Wisconsin has a decided value as a vitamin D carrier.

Baby chicks are injured by cooked feeds.—Holmes and Scott found that chicks fed a cooked ration showed a characteristic illness as the feeding progressed, with a resulting heavy death loss. The affected birds lost control of their leg and neck muscles, and death occurred in 2 or 3 days after the first symptoms appeared. Approximately half of the chicks on a cooked ration were dead at the end of 6 weeks. Adding chopped lettuce to the ration of half of the remaining chicks cleared up the trouble, and normal growth resulted. Raw yeast had a similar but slower effect. That vitamins A and D were not the cause of the disturbances was shown by the fact that adding cod-liver oil to a cooked ration had no beneficial effect.

The growth and development of chicks as influenced by solar irradiation of long visible and ultraviolet wavelengths, respectively, with and without supplementary irradiation of various types, C. Sheard, G. M. Higgins, and W. I. Foster (*Amer. Jour. Physiol., 94 (1930), No. 1, pp. 84–90, figs. 2*).—In this experiment the growth and development of eight lots of 10 chicks each were studied. Lots 1 to 6 were housed behind amber filters and lots 7 and 8 behind corex filters. The amber filters transmitted light from 500$\mu\mu$ to the end of the visible spectrum, while the corex filter transmitted light from 400 to 290$\mu\mu$ with a maximum transmission of 20 per cent at 330$\mu\mu$. Lots 1 and 2 were irradiated on heads only and bodies only, respectively, for 15 minutes daily with a quartz mercury lamp; lot 3 had no supplemental irradiation; lot 4 was irradiated for 20 minutes through a corex filter; lot 5, for 5 minutes daily; lot 6, 10 minutes daily; lot 7, no supplemental irradiation; and lot 8, direct sunlight through amber glass for from 15 to 20 minutes daily.

The chicks in lot 7 did not develop or grow normally, while those in lot 3 were definitely retarded in these respects. The chicks in lot 4 grew normally in weight, but did not develop normal parathyroid glands. Irradiation as in lots 1, 2, and 6 induced normal growth and development, and the results showed that irradiating the heads only was as effective as irradiating the body. The supplementary irradiation as in lot 8 was not sufficient to promote growth comparable to that in lots 1, 2, and 6. Microscopic examinations showed that normal calcification did not occur when the chicks received only the long wave lengths of sunlight. The data on growth and development showed that they closely paralleled the normal development of the parathyroid glands.

Further investigations on the effects of radiant energy on the development of the parathyroid glands of chicks, G. M. Higgins, W. I. Foster, and C. Sheard (*Amer. Jour. Physiol., 94 (1930), No. 1, pp. 91–100*).—In this study eight lots of 15 chicks each were isolated in compartments, six of which were screened by the use of amber filters and two with corex glass. The chicks were confined in the compartments for five months except for certain daily

periods of supplementary irradiation by a quartz mercury lamp through the respective filters. A ration deficient in vitamin D was fed to all lots.

It was found that normal parathyroid glands developed only in the presence of both the visible and ultra-violet portions of radiant energy. The chicks housed behind amber filters and given from 10 to 15 minutes' daily supplemental irradiation developed normal parathyroid glands, but 5-minute periods were not sufficient to compensate for the vitamin D deficiency or for the absence of unfiltered sunlight. The same was true of ultra-violet light transmitted by corex glass. Chicks given from 10 to 15 minutes irradiation daily through a filter transmitting only the longer visible portion of the spectrum developed and maintained normal parathyroid glands during the first two months, but during the third to fifth months pathologic conditions of varied types and extent developed.

Observations on the activities of fowls in the laying house, F. M. Fronda and P. S. Paje (*Philippine Agr., 19 (1930), No. 3, pp. 157–177, fig. 1*).—In this test observations were made for a period of 1 year on the activities of a pen of 50 Cantonese pullets at the University of the Philippines. During part of the time observations were made at 2-hour intervals from 6 a. m. to 6 p. m. and the remainder of the time at hourly intervals from 5 a. m. to 7 p. m. Grain was fed twice daily, and mash and drinking water were available at all times.

The majority of the birds left the perches between 5 and 6 o'clock in the morning and from September to February went to roost about 6 o'clock in the evening, while during the other months they started to roost as early as 5 o'clock. The length of the poultry day was closely associated with the length of daylight. More birds went outside the house on rainy days than on hot days. There was no marked relationship between the percentage of eggs produced and the percentage of birds outside the house either at 6 o'clock in the morning or 5 o'clock in the evening.

With the exception of a few instances, there was no hour of the day when no birds were at the mash trough, and there was a decided tendency for the birds to stay at the troughs from 9 to 11 o'clock in the morning and from 3 in the afternoon to roosting time. There was a fairly even distribution of birds at the water stand throughout the day.

Most of the eggs were laid between 7 o'clock in the morning and noon. The percentage of broody birds was higher during months of heavy production than during months of low production. More birds idled inside the house during the hotter parts of the day than during other hours, and more birds were walking around the yards early in the morning and late in the afternoon than at other hours. A fair percentage of birds were seen scratching outside the house at all hours, and only in a few cases were birds found on the perches between the time they left in the morning until they returned to roost at night.

Effect of force molting laying hens, D. F. King (*Alabama Sta. Rpt. 1930, pp. 28, 29*).—A lot of 100 White Leghorn hens forced into molt during the first 14 days of July had an average production of 129 eggs per bird during the year and made an average profit of $2.25 per head above feed cost. A lot of 50 control hens had an average production of 165 eggs per bird for the year and returned an average profit of $3 per head. Forced molting had no effect on the fertility or hatchability of the eggs or on the mortality of the birds.

The relation of temperature to egg production, O. S. Willham (*[Oklahoma] Panhandle Sta., Panhandle Bul. 28 (1931), pp. 16, figs. 2*).—The data for this study were taken from the trap-nest records of White Leghorn pullets in four egg-laying contests and from the temperature records kept by the station. Only the birds producing 200 or more eggs per year were used in the study.

The results indicate that daily fluctuations in temperature have little effect upon the number of eggs laid by high-producing pullets. There was apparently no definite lag for egg production following temperature changes, but the birds appeared to be more susceptible to changes following periods of high production or when they were ready to go out of condition. Long continued changes in temperature either up or down apparently did not affect production as much as sudden changes either way, and downward changes had a more noticeable effect than upward changes.

The correlation between variations in egg production and temperature was no greater than between daily egg production and temperature. The temperature changes during February and October appeared to have the most noticeable effect on egg production. The results indicate that other climatic factors that operate independently as well as in conjunction with temperature have more influence on production than temperature alone. The author believes that the winter variations in production, which are credited to temperature, are due to factors in connection with feed and care.

Factors in the cost of egg production, F. M. Fronda and P. S. Paje (*Philippine Agr., 19 (1930), No. 6, pp. 337–353, figs. 4*).—At the University of the Philippines a year's study was made on three flocks of 50 Cantonese birds each to determine the factors affecting cost of production. One flock consisted of pullets, one of yearlings, and one of hens.

The pullet flock produced the largest number of eggs and the hens the fewest. The amount of feed consumed was practically the same in all lots, but it required 2.6 kg. of feed in the pullet flock, 2.84 kg. in the yearling flock, and 3.28 kg. in the hen flock to produce 1 doz. eggs. The pullets and yearlings produced most economically during May, while the hens produced most economically during March.

Considering the total expenses, the net income derived from the different flocks represented 41.3 per cent for pullets, 32 per cent for yearlings, and 12.1 per cent for hens.

Grading eggs on the farm, A. E. Jones and C. S. Platt (*New Jersey Stas. Hints to Poultrymen, 19 (1931), No. 7, pp. 4, fig. 1*).—The requirements and tolerance for the New Jersey State Egg Grades, the equipment necessary for grading, and grading for the wholsesale and retail markets are described in this publication.

DAIRY FARMING—DAIRYING

[Experiments with dairy cattle at Wisconsin] (*Wisconsin Sta. Bul. 420 (1931), pp. 79–81, 101, 108–112, figs. 2*).—Several studies are briefly noted.

Do growing calves need vitamin D?—Growing calves were fed a basal ration approximately free of vitamin D, consisting of yellow corn, corn gluten meal, linseed meal, wheat middlings, calcium flour or calcium carbonate, and salt, with ground wood shavings for roughage in studies by I. W. Rupel, G. Bohstedt, and E. B. Hart. Two calves were fed the basal ration only and two received the basal ration plus cod-liver oil. The calves on the basal diet began to show marked disturbances after 6 or 7 months' feeding. The calcium content of their blood was greatly reduced, and symptoms of rickets were apparent. The calves fed cod-liver oil grew normally and showed no indications of rickets.

Fail to improve lime assimilation in high-producing cows.—Hart, O. L. Kline, and G. C. Humphrey added concentrated hydrochloric acid to the ration of cows in amounts varying from 115 to 230 cc. daily. While there was an increased calcium assimilation, there was also an increased loss of lime in the urine, resulting in no net gain. Replacing part of the grain with commercial glucose resulted in no material increase in calcium assimilation.

These results show that the calcium assimilation, due to green grass in the ration, can not be attributed to vitamin D or to the action of sugars or acids.

Pea vine hay from canneries equals alfalfa hay.—Cows were fed by the double reversal method through 3 6-week periods by Rupel, B. H. Roche, and Bohstedt. The basal ration consisted of corn silage, corn, oats, and wheat bran, to which was added either alfalfa or dried pea vine hay. The results showed a slight advantage for maintaining body weight and somewhat more milk secretion for the pea vine hay. When fed to yearling heifers pea vine hay was fully equal to alfalfa hay.

Barley may be ground too finely.—In studies by Bohstedt, Roche, Rupel, and F. W. Duffee, the cost of grinding barley to varying degrees of fineness was determined. It was found that the finer the finished product, the greater was the cost of producing it.

In a test to determine the feeding value of ground barley, 2 lots of 5 cows each were fed the same basal ration through 2 5-week periods. One lot received finely ground barley and the other lot medium ground. These feeds were reversed at the end of the first period. During both periods greater gains in live weight and slightly but consistently higher milk flow resulted on the medium-ground barley ration. Some difficulties were experienced with the finely ground barley because it became pasty when mixed with saliva and caused some animals to go off feed.

Veal production sometimes profitable market for milk.—In a study of the cost and profit of producing veal calves, Bohstedt, Humphrey, and Roche sold calves at ages varying from 10 to 71 days and at weights from 111 to 262 lbs. The calves had received whole milk only fed from a pail after being allowed to run with their dams for 3 days. Calves weighing less than 146.5 lbs. and more than 213 lbs. were discounted on the market. The calves weighing 146.5 lbs. returned the highest price per 100 lbs. of milk fed, and while heavier calves returned a slightly higher total amount the cost of the extra feed did not justify the longer feeding period.

Nutrient requirements for normal growth of dairy cattle, C. H. Eckles and T. W. Gullickson (*Jour. Agr. Research [U. S.], 42 (1931), No. 9, pp. 603–616, figs. 10*).—In this phase of the study the experimental work was conducted in two parts. In the first part the object was to determine whether present feeding standards could be relied upon to serve as guides in feeding dairy heifers for normal growth. Three groups of animals were fed approximately 85, 100, and 115 per cent, respectively, of the nutrients required by the Morrison standard. The second part of this study was to determine the nutrients required for normal growth, and this was accomplished by controlling the amount of nutrients received daily by each animal. This study covered a period of almost 10 years, and data were collected from nearly 50 animals. Only purebred or high-grade females of the Holstein and Jersey breeds were used. The ration fed was believed to be adequate in all essential respects, and the animals were never allowed to go on pasture.

The results showed that the Morrison standard for normal growth of dairy heifers up to approximately 1 year of age was too low, and beyond 1 year of age the standard was too high. The requirements for total digestible nutrients for normal growth of dairy heifers as determined in this study are given in tabular form.

Nutrients used for maintenance by growing dairy cattle, T. W. Gullickson and C. H. Eckles (*Jour. Agr. Research [U. S.], 42 (1931), No. 9, pp. 593–601, figs. 3*).—Continuing this study (E. S. R., 58, p. 870) at the Minnesota Experiment Station, the present results include data from 19 grade or purebred Holsteins used in 31 experimental periods. These periods ranged in length

from 15 to 45 days, the average being 32 days, and the animals ranged in weight from 87 to 861 lbs. The roughage portion of the ration used consisted of good quality alfalfa hay and wheat straw, while the grain mixture was made up of ground corn, linseed meal, and wheat bran 4:1:1. Skim milk was fed to the smaller animals. Each animal was confined in an individual stall bedded with shavings and allowed the freedom of a dry lot for a part of the day when weather permitted. Water was offered once a day in the barn and was available at all times in the lot. Salt and bone meal were kept in each stall.

The results obtained under the conditions of these tests indicated that when the revised net energy value of alfalfa hay was used the requirements for maintenance were slightly lower than the Armsby standard at weights below 350 lbs. and considerably above it at the higher weights. When the earlier Armsby method of calculating net energy was applied to all the feedstuffs in the ration, the amount of net energy received agreed quite closely with the requirements of the Armsby standard. The agreement was not quite so close when the nutrients required and the nutrients received were expressed in terms of total digestible nutrients.

A system of processing roughages for dairy cows, C. F. Monroe and C. C. Hayden (*Ohio Sta. Bimo. Bul. 150 (1931), pp. 90–97, fig. 1*).—The results reported in this article are divided into two parts.

I. *Comparison of roughages processed with and without converter material.*—This is a more detailed account of work previously noted (E. S. R., 64, p. 672).

II. *Processed roughage feeding compared with normal feeding.*—The comparison in the above phase was preceded and followed by a 30-day control period in which the cows were fed in a normal manner. The same grain mixture was fed at the same rate during both periods. The difference between the systems of feeding lay in the fact that in the processing system most of the roughage was fed in a warm, wet, and softened condition after it had been chopped, while in the normal system the cows received ordinary whole hay and corn silage.

The milk production was practically the same on the processed feeding as on the normal feeding. However, butterfat production was from 7.5 to 11 per cent higher on normal feeding. The average difference in butterfat test was approximately 0.32 per cent in favor of normal feeding. The live weights of the cows showed a slight advantage in favor of the processed feeding, which may have been due to fill since the processed feeds, due to their water content, weighed considerably more than did the normal ration.

Soybean silage for dairy cows (*Florida Sta. Rpt. 1930, p. 49*).—One year's tests by R. B. Becker, W. M. Neal, and C. R. Dawson with 8 cows indicated that 1 lb. of No. 1 alfalfa hay was practically equal in feeding value to 3.25 lbs. of soybean silage when fed with a basal ration of corn silage and mixed grain.

Investigations in the feeding of cottonseed meal to cattle, J. O. Halverson and F. W. Sherwood (*North Carolina Sta. Tech. Bul. 39 (1930), pp. 158, figs. 44*).—In concluding this study, a portion of which was previously noted (E. S. R., 64, p. 766), a series of tests conducted over a 5-year period showed that feeding large amounts of cottonseed meal and cottonseed hulls to cattle for a considerable period resulted in a condition commonly known as "cottonseed meal poisoning." Adding certain other feeds to the ration prevented or alleviated this condition and restored sick animals to good health. It was also discovered that the amount of gossypol, the poisonous substance of cottonseed meal, ingested by dairy cows was too small to be injurious. These results led to the conclusion that the deleterious effects of the ration were not due to a poisonous substance contained in the cottonseed meal but were caused by nutritive deficiencies of the ration.

Rations composed of products of the corn plant, particularly white corn, contained minimal amounts of calcium, vitamin A, and possibly phosphorus. Tests with rations composed of cottonseed meal and corn silage or cottonseed meal, white corn, corn stover, and corn silage showed that these feeds derived from the corn plant did not adequately supplement cottonseed meal. Adding calcium carbonate and cod-liver oil to the above rations improved both the health and reproduction of the cows and further substantiated the conclusion that the poor results obtained with the original rations were due to a lack of calcium and vitamin A.

The authors conclude that it is possible to formulate satisfactory rations for dairy cows from a combination of cottonseed meal, cottonseed hulls, and products of the corn plant if calcium is supplied by liberal amounts of gluten feed and stover and sufficient yellow corn is fed to supply the necessary amount of vitamin A. However, better results were obtained if cows were fed liberal amounts of legume hay or allowed access to pasture.

Dairy cattle do not need complex mineral mixtures, C. F. Huffman (*Michigan Sta. Quart. Bul., 13 (1931), No. 3, pp. 137–141*).—Continuing this study (E. S. R., 64, p. 259), it is indicated that the need for mineral supplements for dairy cattle fed under normal Michigan conditions has been greatly exaggerated. Even when timothy hay and other low-calcium roughages were used the need for calcium supplements was small. This conclusion was reached after long-time studies on growth, health, milk production, and reproduction, and after metabolism trials at different stages of lactation.

The cattle in these trials were able to utilize the calcium from their feed more efficiently than was formerly believed. Raw rock phosphate because of its high fluorine content and complex mineral mixtures because they may have a harmful effect when fed over a long period should not be used for dairy cattle. Finely ground limestone rock had no effect on health, growth, reproduction, or milk production.

[Experiments in dairying in Wisconsin] (*Wisconsin Sta. Bul. 420 (1931), pp. 67–72, 123, fig. 1*).—The results of several studies are noted.

New method for detecting neutralization of milk.—A modified method for determining whether milk or cream had been neutralized and the extent of neutralization was worked out by K. G. Weckel and H. H. Sommer. The method involved the precipitating of caesin with hydrochloric acid from a definite volume of milk, filtering, and then acidifying the filtrate to pH 3.2 The buffer capacity of the milk serum was then measured by titrating with N/10 sodium hydroxide to pH 8.4 and compared with a normal table that had been worked out from similar analyses of a large number of authentic milk samples. The buffer capacity of milk or cream increased on souring, but was unaltered by neutralization. The method had an accuracy of within less than 0.02 per cent acidity.

Explanation found for variations in acidity tests.—J. Menos and Sommer found in comparison with the usual acid test of undiluted milk that milk diluted with an equal volume of water gave an acidity reading of 0.0228 per cent lower, and with milk diluted with 9 volumes of water the decrease was 0.0628 per cent. It was shown that in the usual titration of undiluted milk much of the acidity was caused by the precipitation of tricalcium phosphate, and as a result the phosphoric acid was titrated as a tribasic rather than a dibasic acid. With more water present in the diluted samples, less tricalcium phosphate was precipitated, and with such samples the phenolphthalein end point was reached at a lower pH, giving a lower reading.

Low citrate content increases "cream plug" difficulty.—In this study it was found that a low citrate content in cream was one of the contributing causes of

the cream plug. H. L. Templeton and Sommer found that the low citrate content tended to increase the undesirable effects in cream due to handling. Adding 6 oz. of sodium citrate to each 1,000 lbs. of cream before pasteurizing prevented cream plug formation unless the cream was excessively agitated.

Many metals are soluble in milk.—Continuing this study (E. S. R., 63, p. 71), H. T. Gebhardt and Sommer found that aluminum was very resistant to corrosion when no other metals were present, but was attacked somewhat in high-acid milk at high temperatures, and when in contact with other metals its solubility was greatly increased. Copper and copper alloys were similar in their solubility under varying conditions and were more soluble in milk than were aluminum or stainless steel. Nickel was very rapidly dissolved, while zinc and galvanized iron did not resist steam sterilization and had a low resistance against acid milk. Tin-coated metals were not particularly resistant to the corrosive effect of the cleaning compounds, and solder-coated copper was especially soluble in milk. Allegheny metal and stainless steel were quite resistant to the solvent effects of milk under all conditions.

Lower storage temperatures better for acidophilus milk.—Studies by H. Tranmal and E. G. Hastings showed that when acidophilus milk is stored at from 50 to 55° F. the number of bacteria were practically the same after 3 or 4 weeks as when originally put in storage. The quality and flavor of the product showed little or no impairment during this period.

Preparing samples of milk for the methylene blue reduction test, H. B. Ellenberger and R. I. Moody (*Vermont Sta. Bul. 312* (*1930*), *pp. 23*).—In this study 198 samples in all were taken as milk was delivered to the creamery. The samples were taken from cans containing night's and morning's milk separately and from cans containing mixed night's and morning's milk. After the night's and morning's milk samples had been prepared for the methylene blue tubes, the remainder of the milk was mixed and another sample taken.

This study showed that samples taken with a 10-cc. dipper were as satisfactory as samples taken with a pipette. The dipper should be cleansed between samplings by rinsing in cold water and then in either boiling water or in a chlorine solution. The tubes used should be washed and then steamed or boiled or filled with a chlorine solution for 5 minutes before using again. For measuring the methylene blue solution a burette was more rapid and as satisfactory as a pipette.

The 10-cc. sample of milk can be placed directly in the test tube, and if the test is to be started immediately the methylene blue can be run into the milk from a burette and mixed by inverting the tube. The samples can be held for 1 or even 2 hours before starting the test if kept between 32 and 50° F. Holding for short periods at 75° did not appear to affect the test seriously.

Sampling from both night's and morning's milk was found to be useful in detecting the cause of poor milk. The methylene blue test does not give a wholly accurate or complete picture of milk quality, and the direct microscopic examination is of value for the further study of milk that reduces methylene blue quickly.

Preparation of acidophilus milk from milk treated by electricity, H. D. Devereux (*Amer. Jour. Pub. Health, 20* (*1930*), *No. 9, pp. 1009, 1010; abs. in Michigan Sta. Quart. Bul., 13* (*1931*), *No. 3, p. 160*).—At the Michigan Experiment Station samples of milk pasteurized by the Electropure process were inoculated with from 2 to 3 per cent of a 24-hour culture of *Lactobacillus acidophilus* and were incubated at 37.5° C. for about 24 hours. A desirable product with a fine, soft, easily broken curd and from which little whey was expressed resulted from this method of procedure. The cultured milk had a

freshly soured taste, and there was no decided cooked flavor. The growth of the organisms remaining in the original milk was unimportant. The advantages of this method lie in the ease with which the milk can be prepared for inoculation, in the fact that whole milk can be used and that no special sterilizing equipment is necessary, and in the fact that a desirable product results.

Use high temperatures to pasteurize ice cream mix, F. W. FABIAN (*Michigan Sta. Quart. Bul., 13 (1931), No. 3, pp. 132–134*).—Cultures of *Escherichia coli* grown for 24 hours at body temperature were introduced into tubes of sterile ice cream. The tubes were then heated to 140, 145, 150, or 155° F. for 30 minutes, were then tested for growth, kept for several days, and retested. Four trials were conducted at each temperature. The percentage of cultures surviving at 140° were 51.2, 29, 36, and 57; at 145°, 22.7, 6.8, 2.2, and 22.7; at 150°, 0, 2.4, 2.4, and 9.1, while at 155° all cultures were killed in all four tests.

In an effort to determine whether one constituent in ice cream had a greater protective action for bacteria than any other, concentrates of the various ingredients in the percentage range used in making ice cream were tested using the above technic. Butterfat and gelatin were found to have no protective action, while skim milk powder and sucrose showed a slight protective action at 140°. These results show that no single ingredient exerted much protective action.

VETERINARY MEDICINE

[Work in animal pathology at the Wisconsin Station] (*Wisconsin Sta. Bul. 420 (1931), pp. 91–100, 122, 123, figs. 3*).—Brief reference is first made to work by B. A. Beach, C. R. Strange, C. Holmes, and J. G. Halpin with bacillary white diarrhea in continuation of that previously noted (E. S. R., 63, p. 73). Their studies have failed to support the view that this disease is of great economic importance in the State.

A disease known as "slipped tendon" is said to have appeared among chicks grown under artificial conditions and has been a source of considerable loss. Chicks 4 weeks old or older have been the most susceptible to this peculiar type of leg malformation, characterized by a flattened condition at the juncture of the tibia and femur bones of the leg, impairing growth and disturbing the gait. It is not due to rough handling nor to lack of perches; nor is it rickets, since there is excellent bone formation. It is rather an abnormal shaping of the legs and joints. Trials by Holmes, Halpin, E. B. Hart, and H. T. Scott have shown that it is not due to a low fiber content of the ration. The heavier breeds appear to be more susceptible, although it does occasionally occur in the lighter breeds of poultry.

An account is given of progress of work with infectious abortion in cattle (E. S. R., 63, p. 73). A summary of the history of cows on the nutrition-abortion experiment at the end of the fourth year and a comparison of reactor cows on the basis of degree of reaction 2 years after the first exposure are reported in tabular form. The findings indicate that the ravages of an infectious disease like infectious abortion are not lessened by the inclusion in the ration of minerals, vitamin carriers, or similar supplements. No difference was found in the mineral constituents of the blood. Both the natural and acquired immunity were demonstrated. Of the 33 cows in the experiment which had at one time reacted to the blood test, only 4, or 13 per cent, continued to react at the end of the fourth year, 2 years after being exposed to the infection.

It is pointed out that herd history is a valuable aid in diagnosing bovine tuberculosis; also that "gargety" cows are occasional carriers of septic sore throat of men. The statistical study made by E. G. Hastings, I. D. Thompson,

and Beach of no-lesion reactors shows that most of them came from herds in which only one animal reacted to the tuberculin test. Repeated experiments with healthy dairy cows by W. D. Frost, M. Gumm, F. B. Hadley, and W. E. Welsh demonstrated that it is relatively easy for cows to become infected with the septic sore throat organism, *Streptococcus epidemicus*, and that these infected animals show such symptoms of mastitis as fever, depressed milk flow, and an abnormal appearance of the milk. Infection occurred when the organism was rubbed lightly over the end of the teat of a healthy cow.

Mention is made of a digestive disorder of lambs caused by overfeeding that was studied by Hadley and Strange. Two important causes seem to stand out as a result of the investigation, (1) overfeeding of concentrates and (2) lack of exercise due to too close confinement, or more often a combination of the two conditions. It is concluded that the disease is not infectious in nature.

In work conducted by H. R. Dithmar, I. L. Baldwin, and S. B. Miller the germicidal value of hydrogen peroxide, as shown by its killing of *Escherichia coli* and *Staphylococcus aureus*, was increased a hundredfold by the addition of ferric sulfate or cupric sulfate at the rate of one part per million. Manganous sulfate also has the same ability but requires the presence of potassium dichromate. Since these salts, which promote the germicidal action of hydrogen peroxide, have the known effect of a catalytic agent in increasing the decomposition of the hydrogen peroxide through the liberation of oxygen, it is concluded that the germicidal quality of hydrogen peroxide is dependent upon its property as an oxidizing agent.

[A study of the skin flora and of the possible etiology of the hemorrhagic eschar type of skin lesion of white rats], W. D. SALMON and S. J. SCHILLING (*Alabama Sta. Rpt. 1930, p. 28*).—Seventy-two cultures were attempted by the authors from closely clipped areas of skin on rats in the stock room and the experimental room in the laboratory, with the result that 59 were sterile and only 2 of the other 13 showed more than 1 to 5 colonies of bacteria after 48 hours' incubation. In no case did a normal skin yield a culture of a pigmented, Gram-positive coccus.

Studies of the etiology of the hemorrhagic eschar type of skin lesions that were so frequently encountered in the laboratory showed that a minute white mite occasionally found on some of the rats did not have a causal relation to the lesions. This confirms an earlier conclusion that an external parasite is not an etiologic factor for the skin lesions.

A disease of parrots communicable to man (psittacosis), E. L. STURDEE and W. M. SCOTT (*[Gt. Brit.] Min. Health, Rpts. Pub. Health and Med. Subjs. No. 61 (1930), pp. 132, pls. 9, figs. 7*).—Following an introduction (pp. 9, 10), the subject is dealt with in part 1 under the headings of Historical References, by S. L. Simpson (pp. 10–17); Epidemiology (pp. 17–25); Clinical Aspects (pp. 25–50) and Pathology (pp. 50–55), both by S. L. Simpson; Administrative Action (pp. 55–57); References (pp. 57, 58); and in part 2 under Aetiology—Experimental Observations, by S. P. Bedson and G. T. Western (pp. 59–94); References (p. 95); and Virus Studies in Relation to Psittacosis, by M. H. Gordon (pp. 96–107). The appendixes include (1) a table showing age and sex groups and mortality rate, (2) a table giving chief symptoms and other details of cases to which reference is made in the section relating to clinical aspects of psittacosis in part 1, (3) a discussion of a typical severe case of psittacosis with recovery, (4) a discussion of a typical fatal case of psittacosis, (5) suggestions for the transport and keeping of birds, reprinted from the Proceedings of the Zoological Society of London, 1928, Part II, and (6) a table giving the distribution of 125 cases of human illness associated with sick birds.

Tularemia in sheep and wild animals [trans. title], F. VOLKMAR (*Berlin. Tierärztl. Wchnschr., 47 (1931), No. 9, pp. 131–133*).—A discussion presented in connection with a list of 12 references to the literature.

Anaplasmosis in cattle, D. A. SANDERS (*Florida Sta. Rpt. 1930, pp. 53, 54*).—In the course of work conducted an animal that was injected intravenously with large amounts of blood taken from 2 cows in a dairy herd in which anaplasmosis had been prevalent for 2 years came down with a typical case of the disease 32 days after injection.

[Effect of a calcium chloride solution injected in the treatment of milk fever and grass staggers], L. SEEKLES, B. SJOLLEMA, and F. C. VAN DER KAAY (*Tijdschr. Diergeneesk., 57 (1930), No. 24, pp. 1341–1373; Ger., Eng., Fr. abs., pp. 1346–1351*).—The occurrence among the great number of recoveries of many cases of recidive, or relapse, with now and then a death, following the intravenous injection of calcium chloride solution led to the present studies in which the salt was injected into 37 cows suffering from milk fever and into 20 suffering from grass staggers. The occurrence of recidive is independent of the quantity of calcium chloride injected. The injection of solutions of calcium salts was found to influence the frequency of the heart beat in cows suffering from milk fever and grass staggers in four different ways, which are described.

An outbreak of disease amongst imported pedigree cattle at the Veterinary Quarantine Station, Nairobi, R. W. M. METTAM (*Jour. Compar. Path. and Ther., 44 (1931), No. 1, pp. 50–70*).—An account is given of a disease, characterized by hemorrhages into the skin, subcutaneous tissues, submucosae, and one or more of the serous cavities, which was the cause of a severe mortality among imported pedigree bovines in the Veterinary Quarantine Station at Nairobi during the early months of 1929. Its cause remains obscure. Bacterial, protozoan, and filter-passing viruses can be definitely excluded as the causal agent. The disease was not transmissible to other cattle or to horses, sheep, and rabbits. The mortality in untreated animals was 100 per cent. Adrenaline hydrochloride administered freely in large doses proved to be a specific.

"Struck": Enteritis and peritonitis of sheep caused by a bacterial toxin derived from the alimentary canal, A. D. MCEWEN and R. S. ROBERTS (*Jour. Compar. Path. and Ther., 44 (1931), No. 1, pp. 26–49*).—This contribution deals with a specific disease of sheep, characterized by an acute and fatal enteritis, peritonitis, and toxemia, which is seasonal, occurring mainly during the late winter and spring months. The disease has been produced by feeding large quantities of broth cultures of *B[acterium] paludis* and by feeding the bacteria suspended in fresh nutrient broth.

"In natural cases of the disease *B. paludis* toxin has been demonstrated in the contents of the alimentary tract, and in natural and experimental cases evidence of the passage of this toxin into the body is available, the toxin having been found in the peritoneal fluid under conditions which preclude the production of that toxin in the peritoneal cavity, which suggests that it was derived directly from the contents of the alimentary canal. The enteritis and peritonitis and toxemia are ascribable to *B. paludis* toxin derived from the alimentary canal."

Bacillus suipestifer as a cause of meat poisoning [trans. title], H. S. FRENKEL and A. CLARENBURG (*Tijdschr. Diergeneesk., 58 (1931), No. 6, pp. 299–307; Ger., Eng., Fr. abs., p. 307*).—The authors report upon an epidemic of meat poisoning (acute gastroenteritis) which resulted from the consumption of meat of a diseased pig infected with *B. suipestifer*.

Studies in dog distemper.—VI, Dog distemper antiserum, P. P. LAIDLAW and G. W. DUNKIN (*Jour. Compar. Path. and Ther., 44 (1931), No. 1, pp. 1–25, figs. 15*).—This is a report of studies conducted in continuation of those pre-

viously noted (E. S. R., 62, p. 265; 65, p. 270). Hyperimmune sera against dog distemper is said to vary considerably in potency. Its protective value is best estimated by determining what modification, if any, is induced in a distemper attack when small doses of serum are given in the incubation period of the disease. Immune serum obtained from dogs will, under certain conditions, prevent distemper attacks in ferrets. It has not yet proved feasible to standardize dog serum by the use of ferrets. Hyperimmune serum, in addition to its protective property, possesses the power of fixing complement in the presence of distemper virus.

Ten thousand autopsies, F. R. Beaudette and C. B. Hudson (*New Jersey Stas. Hints to Poultrymen, 19 (1931), No. 6, pp. 4*).—This is a report upon autopsies of fowls made from July 15, 1928, to June 30, 1930, of 9,952 specimens received for examination from 3,719 farms. Of the 2,739 due to bacterial diseases, 2,281 represented pullorum disease, 300 fowl cholera, 76 fowl typhoid, 53 tuberculosis, 26 paratyphoid infection, and 3 Streptococcus infection. Roup was represented by 137, botulism by 34, aspergillosis by 14, and favus by 2. Of the protozoan diseases, coccidiosis was represented by 1,422, enterohepatitis by 304, and flagellatosis by 31. Of the many parasitic diseases investigated, the large roundworm (*Ascaridia lineata*) was found in 777, followed by the cecal worm (*Heterakis papillosa*) 518, tapeworms of various species 506, *Capillaria annulata* 108, etc. Of deficiency and dietary diseases visceral gout was responsible for 120, followed by improper feeding 118, "crazy diseases" 108, vitamin A deficiency 98, vitamin D deficiency 80, and "hock disease" 37. A total of 1,078 cases due to virus diseases and 64 cases due to poisoning is also listed.

Causes of mortality in laying hens, H. J. Stafseth and E. S. Weisner (*Michigan Sta. Quart. Bul., 13 (1931), No. 3, pp. 153–157*).—This is a report of the eighth-year mortality records kept of the Michigan International Egg Laying Contest commenced on November 1, 1922. The diseases and causes contributing to or causing death were determined by autopsy and by culturing of various organs. The data given show the number of birds that died each year of the contest and the 2,176 diseases or contributing causes for the 1,898 birds. The diseases and causes which appear to be on the increase are peritonitis, sarcomatosis, bronchitis, pericarditis, tumors, leucosis, and diseases attacking the organs of egg production. The number of deaths of each breed and variety for the various diseases and causes over the 8-year period, the total number of hens of each breed and variety entered, total deaths, and percentage of mortality for the eight contests, and the number of deaths each month during the 8 years are also tabulated. The total percentage mortality of 18.98 for the 8-year period is deemed very significant, indicating that nearly one-fifth of the pullets die during their first year of egg production.

Hemoglobinophile bacteria the cause of coryza infectosa gallinarum [trans. title], L. de Blieck (*Tijdschr. Diergeneesk., 58 (1931), No. 6, pp. 310–314; Ger., Eng., Fr. abs., pp. 313, 314*).—The author has separated coryza from fowl pox diphtheria by infecting birds which were immunized against fowl pox with antidiphtherin. He succeeded in infecting birds in series with pure coryza. From a case of pure coryza the author isolated a bacillus which could be classified as a bacterium of the influenza group. With subcultures in 8 passages, 17 fowls could be infected which showed the typical coryza symptoms. It was also possible to infect other birds from these with culture infected fowls.

An atypical fowl-plague virus from Egypt, H. S. Purchase (*Jour. Compar. Path. and Ther., 44 (1931), No. 1, pp. 71–83*).—Work at the Ministry of Agriculture laboratories has shown the Egyptian virus to be distinct from that causing

Newcastle disease in England (E. S. R., 58, p. 77), pseudo-fowlpest in the Dutch East Indies (E. S. R., 61, p. 74), and a similar disease in the Philippine Islands.

In the studies reported, fowls affected with the Egyptian disease never presented any excessive salivation or the subdued croaking often encountered in Newcastle disease. The Egyptian virus is not pathogenic for pigeons, and immunologically it is distinct from the Newcastle virus. Contact experiments were successful in only 25 per cent of the 12 pairs tested. It is pointed out that from personal observations made on a number of occasions when using the Newcastle virus a contact was never known to escape infection. The Egyptian virus differs from the ordinary fowl plague in two ways: (1) The period of incubation, which in the Egyptian disease is over 4 days, is more than twice that of ordinary fowl plague; and (2) the infectivity of the blood is low, the highest minimal lethal dose being 0.001 cc., while in fowl plague a minimal lethal dose of 0.00001 cc. is common, and in some cases a millionth of a cubic centimeter or less is infective. It is concluded that this disease is in reality a form of fowl plague, although running a slower course and showing the virus in less concentration in the blood.

Infectious trachitis, C. S. Gibbs (*Massachusetts Sta. Bul. 273 (1931), pp. 25–55, pls. 4*).—This report of studies of a disease of poultry, known to have been present in Massachusetts since 1921 and caused heavy losses in the State, to which the name "trachitis" is applied by the author, is based upon experimental work with 10 strains of the virus which came from widely separated towns in the State, 2 from California, and 2 from New Jersey.

The clinical symptoms of the disease, as noted in this study, include "pale face, ruffled appearance of the feathers, lacrimation of the eyes, elevation of temperature, lack of appetite sometimes accompanied by emesis, cyanotic coloration of the comb and wattles, dyspnea, weakness, the formation of pseudomembrane in the visible parts of the respiratory tract, swelling of the infraorbital sinuses, death due to suffocation, toxemia, or general debility. Gross lesions of infectious tracheitis were especially prominent in fowls and absent in young chickens dead of the disease. The most common lesions of infectious tracheitis revealed by this investigation were desquamative epithelial inflammation of the trachea, the formation of pseudomembrane in the respiratory tract, congestion and sometimes fatty degeneration of the liver, inflammation of the spleen, and hemorrhages of the kidney. Congestion and consolidation of the lungs occurred in a few cases.

"The histopathology of infectious tracheitis varied considerably in individual birds. The following lesions were usually found in this study: Hyperemia of the trachea, larynx, and abdominal organs; desquamative inflammation of the ciliated epithelial layers of the trachea and larynx; fibrinopurulent infiltration of the mucosa of the trachea; hemorrhagic infiltration into the alveolar spaces of the lungs, tubular spaces of the kidneys, and the mucosa and submucosa of the trachea; inflammation and sometimes fatty degeneration of the liver. Inflammation of the spleen was observed in some cases.

"Viruses from acute field cases of infectious tracheitis were successfully propagated under laboratory conditions. Viruses from chronic field cases of infectious tracheitis lost their potency when transmitted in series under laboratory conditions. Viruses from the acute field cases of infectious tracheitis studied in this investigation were filtrable. These viruses consistently passed the pores of Berkefeld V and Seitz filters in sufficient quantities to successfully inoculate fowls, pullets, cockerels, and chickens. Some of the viruses were partially retained by the Berkefeld N filters, used in these experiments, so that susceptible birds were not always successfully inoculated with the filtrates. These viruses were not demonstrated in the filtrates passing through Berkefeld W

filters. Fowls, pullets, cockerels, and chickens were not successfully inoculated by the subcutaneous method. Six chickens inoculated intravenously with the virus of infectious tracheitis failed to develop the disease, while the controls inoculated intratracheally with the same virus died.

"Comparative studies of infectious tracheitis from Massachusetts, California, and New Jersey showed immunological differences between acute and chronic cases. The virus of the second California strain of infectious tracheitis was demonstrated in the macerated tissues of the liver, spleen, trachea, and kidney of chickens dead of the disease. Two healthy carriers of infectious tracheitis were found in which the virus remained viable in the tracheal exudate for two and four weeks, respectively, after all visible symptoms of the disease had disappeared. The virus of infectious tracheitis was demonstrated in the cloacal contents of three of the birds infected with the first California virus and four of the cockerels and pullets suffering from an infection with the first New Jersey strain. Chicken pox vaccination did not protect domestic fowls against infectious tracheitis."

Paralysis of the domestic fowl, E. F. Thomas (*Florida Sta. Rpt. 1930, p. 54*).—In studies commenced in 1928 and 1929 (E. S. R., 63, p. 671), paralysis was not produced by the continuous use of antiseptics in drinking water. In the course of the experiments, which extended over a period of 12 months, potassium permanganate ⅛ teaspoon to each gallon of water, bichloride of mercury 6 grains to each gallon of water, and a hypochlorite solution 1 tablespoon to each gallon of water were used.

No cases of paralysis were produced by feeding various tissues from diseased chickens to chickens of a susceptible age in which an enteritis had been artificially produced. In studying the autopsy records of all paralyzed chickens examined during the time this work had been in progress, it was observed that an enteritis was present in every case of the disease.

A piroplasma detected in poultry in Egypt (Egyptianella pullorum) [trans. title], M. Carpano (*Clin. Vet.* [*Milan*], *52* (*1929*), *No. 6, pp. 339–351, pls. 2; abs. in Trop. Vet. Bul., 17* (*1929*), *No. 4, pp. 115, 116*).—These data relate to *E. pullorum*, a description of which and a report of observations have been noted (E. S. R., 62, p. 775).

Pullorum disease, A. Broerman (*Ohio Sta. Bimo. Bul. 150* (*1931*), *pp. 83–89; also Ohio Sta. Spec. Circ. 33* [*1931*], *pp. 8*).—This is a brief practical account of pullorum disease and means of detection by the agglutination test.

Epidermoid cancers on the feet of wild birds, M. W. Emmel (*Jour. Amer. Vet. Med. Assoc., 77* (*1930*), *No. 5, pp. 641–644, figs. 2; abs. in Michigan Sta. Quart. Bul., 13* (*1931*), *No. 3, p. 164*).—This is a report upon studies made at the Michigan Experiment Station of tumorous masses that occurred on the feet of wild birds caught for banding purposes during the last few years. These tumors had involved the skin of the foot, both on the ventral and dorsal surfaces. The birds affected included the slate-colored Junco and the bronzed grackle, the tumors being of the nature of cancers affecting the outer layer of the skin. No indication was found showing that these tumors were malignant. It is suggested that they may be the result of a physical injury.

AGRICULTURAL ENGINEERING

[Agricultural engineering investigations at the Alabama Station] (*Alabama Sta. Rpt. 1930, pp. 9–11*).—The results of studies in agricultural engineering, some of which have been previously noted (E. S. R., 64, p. 383), are reported

In weed-control studies by E. G. Diseker, tests of various methods of precultivation indicated that factors such as depth and time of plowing, time of harrowing, and the use of the jointer and coulters had little or no effect on subsequent weediness of the cotton crop. An adjustable spike-tooth harrow used on sandy soil reduced the weed infestation from 75 to 78 per cent without seriously injuring the stand of cotton. The rotary hoe was a satisfactory implement for the cultivation of young corn and cotton during a dry season on both Black Belt and sandy soils.

Experiments by Diseker with machinery for harvesting and planting oats showed that the windrow harvester when used with the pick-up attachment on the combine was better adapted to harvesting oats under Alabama conditions than the combine alone.

A study by A. Carnes of the factors affecting the design of equipment for utilizing solar energy to heat water resulted in the development of a practical design, which consisted of a glass-covered insulated box containing an absorber made of 0.25-in. copper tubing soldered in the valley of galvanized corrugated roofing. The absorber surface was painted black. The water to be heated was circulated through this tubing and stored in an insulated tank. Sufficient heat was furnished by 30 sq. ft. of exposed absorber to raise the temperature of 30 gal. of water from 68 to 115° F. in an average of 3 hours on sunny days. A formula for the design of other capacity absorbers follows: $Q=AT/d$, where Q equals British thermal units of heat desired, A equals area of absorber exposed at right angles to sun's rays, T equals number of degrees of temperature through which water is to be heated, and d equals thickness of metal in the absorber surface.

In the tractor lug studies by J. W. Randolph, the coefficient of rolling friction for the single wheel in Norfolk sand was found to be extremely high. The rolling resistance of a wheel with lugs varied with reference to lug position. Maximum resistance was obtained when the lug was 2.5 to 2.75 in. ahead of center for a 1.25-in. lug and from 3.5 to 4.5 in. ahead of center for a 2.5-in. lug. Lugs tended to prevent the wheel from sinking into the soil, but they increased the rolling resistance. Laboratory results obtained from a single wheel with a smooth rim checked closely with results obtained by the Jaudasek formula. The average rolling resistance of the wheel with lugs in Norfolk sand also checked closely with the results calculated by the Jaudasek formula, but as the lug entered the soil a peak of resistance was developed which was much higher than the calculated resistance. This peak depended upon lug size, lug spacing, and soil hardness. After the lug passed over the bottom wheel center, the rolling resistance was found to be less than the calculated resistance.

Studies by M. L. Nichols of the various soil constants which best indicate the physical factors affecting tillage led to the conclusion that the Atterberg consistency constants are the most satisfactory indexes to the physical properties of the soil. It was found that a definite relationship exists between friction values, shear, resistance to compression, and these constants. The general reaction of a soil to an implement also was found to be a function of the physical properties indicated by the Atterberg constants and could be accurately predicted at any moisture constant.

Surface water supply of the United States, 1927, I, III, V (*U. S. Geol. Survey, Water-Supply Papers 641 (1931), pp. VII+168, fig. 1; 643 (1931), pp. VII+216, fig. 1; 645 (1931), pp. V+115, fig. 1*).—Of the papers which here present the results of measurements of flow made on streams during the year ended September 30, 1927, No. 641, prepared in cooperation with the States of Maine, New Hampshire, Massachusetts, New York, New Jersey, Maryland,

and Virginia, covers the north Atlantic slope drainage basins; No. 643, prepared in cooperation with the States of New York, West Virginia, Ohio, Virginia, Illinois, Tennessee, North Carolina, and Alabama, the Ohio River Basin; and No. 645, prepared in cooperation with the States of Minnesota, Wisconsin, Iowa, Illinois, and Missouri, the Hudson Bay and upper Mississippi River Basins.

A study of the influence of herbaceous plant cover on surface run-off and soil erosion in relation to grazing on the Wasatch Plateau in Utah, C. L. Forsling (*U. S. Dept. Agr., Tech. Bul. 220 (1931), pp. 72, pls. 2, figs. 29*).—This is a contribution from the Intermountain Forest and Range Experiment Station of the U. S. D. A. Forest Service. It presents the results of 15 years' measurements of precipitation, surface run-off, and erosion from summer rains and 7 years' measurements of melted snow run-off and erosion on two experimental watersheds on the Wasatch Plateau in central Utah.

The average annual precipitation on the areas studied was 29.51 in. Soil moisture studies showed that on the experimental areas there was no contribution to the underground water supply from summer rains, and that this supply is fed by the melting of the snow in the spring. Only 4.6 per cent of the average annual surface run-off was caused by summer rainstorms when there was a 16 per cent cover of vegetation, but this run-off caused 84.5 per cent of the erosion. After the vegetation had increased to 40 per cent of a complete cover, only 1.3 per cent of the annual run-off was from summer rains. Degree of slope, character of drainage system, and chemical and physical properties of the soil were found to be more or less permanent factors which influence run-off and erosion. The degree of temperature, duration, and distribution of cold and warm periods, and the distribution of snow on the watersheds were the chief additional factors influencing the percentage of surface run-off from melted snow in the spring. Quantity and intensity of rainfall in a storm and the moisture content of the soil influenced summer rainfall run-off.

The quantity of sediment eroded by summer rainfall run-off varied more or less directly with the quantity of run-off, although it was influenced to some extent by the size of run-off, the trampling of livestock, and the dryness of the soil. The increase in the density of the vegetation from 16 to 40 per cent of a complete cover and the replacement of certain plants by others with more extensive and more fibrous root systems reduced the rainfall surface run-off 64 per cent, the rainfall erosion 54 per cent, and the melted snow erosion 57 per cent.

The results in general indicate the importance of herbaceous vegetation in reducing rainfall run-off and floods and in controlling erosion.

Dense concrete tile show increased endurance in peat soils (*Wisconsin Sta. Bul. 420 (1931), pp. 48, 49, fig. 1*).—Experiments with dense concrete tile have shown an increased endurance in peat soils, but they were only 74 per cent as strong 5 years after laying as when located in mineral soils, where they actually improved with age. Large sized concrete tile were more durable in peat than in the smaller sizes.

Orchard drainage in the Medford area, Jackson County, Oregon, M. R. Lewis and A. Work (*Oregon Sta. Circ. 100 (1931), pp. 24, figs. 9*).—This is a report of investigations carried on under a cooperative agreement between the station, the U. S. D. A. Bureau of Public Roads, and Jackson County, Oreg. It reports the results of studies, covering a period of 16 months, which indicate that the high water table found in parts of the area is responsible for serious orchard problems. Information is given on practical methods of drainage which are primarily of underground character.

Public Roads, [March–April, 1931] (*U. S. Dept. Agr., Public Roads, 12 (1931), Nos. 1, pp. 20+[2], figs. 17; 2, pp. 21–48+[2], figs. 34*).—These numbers of this periodical contain data as to the status of Federal-aid road construction as of February 28 and March 31, 1931, respectively, together with the following articles:

No. 1.—A Study of the History and Present Status of Toll Roads in the United States and Other Countries, by H. H. Kelly (pp. 1–10); The Effect of Vibration on the Pressure of Concrete Against Form Work, by L. W. Teller (pp. 11–15); Motion-Picture Films on Road Construction Available (pp. 16, 17); and 1930 Motor Vehicle Registrations and Receipts, by L. A. Abbot (pp. 18–20).

No. 2.—Impact Reactions Developed by a Modern Motor Bus, by J. A. Buchanan (pp. 21–36); The Effect of the Dimensions of Test Specimens on the Flexural Strength of Concrete, by F. V. Reagel and T. F. Willis (pp. 37–46); Meeting of the Joint Committee on Concrete and Reinforced Concrete (p. 47); and Analysis of Motor Vehicle Accidents in California (p. 48).

Sprayer accessories affect efficiency of equipment, G. R. STARCHER (*Michigan Sta. Quart. Bul., 13 (1931), No. 3, pp. 147–152, fig. 1*).—This is a condensed report of the results of studies to determine the relation to pressure loss and to delivery from the nozzle of variations commonly found in the hose, hose fittings, cut-offs, rod parts, and gun and nozzle disks. All tests were made on a sprayer equipped with a 3-cylinder pump with a rated capacity of 16 gal. per minute. The pump was operated with a 5-h. p. electric motor which was substituted for the usual gasoline engine. Tap water was used for all tests. A standard, single nozzle spray gun was used in most of the work, though for certain of the studies multiple nozzle rods were substituted. Pressure gauges of the type usually furnished on sprayers were used, and they were calibrated from 0 to 600 lbs. in units of 10 lbs.

It was found that with equal pressures at the gun increasing the disk aperture gives an almost equally uniform increase in delivery at each pressure. The increases are greater at high than at low pressures. The increase, however, is less than the proportional increase in the area of the aperture. Doubling the diameter slightly more than doubles the delivery, and as the aperture is gradually increased there is a slightly more rapid increase in delivery.

Uniform changes in pressure gave equally uniform changes in delivery. Increasing the pressure at the gun from 200 to 400 lbs. with disk apertures of 4, 6, 7, 8, 9, 10, and 12 increased the deliveries 43, 42, 43, 45, 45, 43, and 44 per cent, respectively. The delivery and pressure at the gun with hose of small diameter, when the disk aperture and pressure at the pump are uniform, may be much less than with hose of large diameter.

The substitution of hose fittings with large openings for the so-called ordinary fittings with small openings makes a marked difference in pressure loss and consequently in delivery with ⅜- and ½-in. hose, but less difference is noticeable with ¾-in. hose with deliveries up to 16 gal. per minute. For equal pressures ⅜-in. hose with large fittings is as efficient as ½-in. hose with ordinary fittings, and ½-in. hose with large fittings approaches ¾-in. hose in efficiency. No significant differences are shown between the two types of fittings on ¾-in. hose. Under certain conditions it is possible to substitute the lighter and less expensive hose for the larger and heavier hose, provided fittings with large openings are used.

It was found that the length of the hose up to 50 ft. was not so significant in reducing pressure as the type of fittings used. A comparison of 50 and 12.5 ft. of ⅜-in. hose showed that the reduction of 75 per cent in length reduced the pressure loss from about 25 to 30 per cent with both ordinary and large fittings.

A rod with 4 nozzles will not deliver quite 4 times as much liquid as a single-nozzle gun with a disk with the same aperture as those used in the rod. There is more friction in the rod than in the gun because a rod which delivers the same volume of spray as a gun requires greater pressure. All cut-offs were efficient so long as used on the types of rod for which they were intended. A small cut-off is satisfactory on a rod with 3 or 4 nozzles, but larger cut-offs are desirable for 6- and 8-nozzle rods. The number of holes in the nozzle whirl plates affects the delivery from the nozzle. A plate with 4 holes offers greater resistance than one with 6 holes and the number of holes has a marked effect on the pattern of the spray. A more spreading type of spray which will travel a shorter distance is formed with the 4-hole whirl plates.

The use of logs and poles in farm construction, T. A. H. Miller (*U. S. Dept. Agr., Farmers' Bul. 1660 (1931), pp. II+26, figs. 33*).—Practical information is given relating to the chief points to be observed in building with logs and poles.

The trench silo, J. C. Grimes and M. L. Nichols (*Alabama Sta. Circ. 59 (1931), pp. 8, figs. 3*).—Practical information is given on the construction of the trench silo. It was found that a long, shallow trench is cheaper than a short, deep one. The cost of filling a trench silo is less than that for an upright silo.

A plan for the milk house, W. A. Foster, H. A. Ruehe, and C. S. Rhode (*Illinois Sta. Circ. 371 (1931), pp. 4, pl. 1, fig. 1*).—Working drawings and practical information are given for the construction of a milk house designed to meet the minimum requirements of most cities in and adjacent to Illinois at a low cost for house and overhead.

Directions for building Illinois shed-roof poultry house, E. G. Johnson and H. H. Alp (*Illinois Sta. Circ. 368 (1931), pp. 4, pl. 1, figs. 3*).—Working drawings and practical information are given for the construction of the Illinois shed-roof poultry house, previously more fully described (E. S. R., 61, p. 179).

Electrifying the kerosene incubator, O. E. Robey (*Michigan Sta. Quart. Bul., 13 (1931), No. 3, pp. 114, 115, fig. 1*).—The results of tests are briefly reported on the use of electricity to heat incubators designed to operate on kerosene. It was found that electricity at 3 cts. per kilowatt hour will cost about 1.5 cts. per day more than kerosene, but this will probably be more than offset by the reduced fire risk and the lesser amount of care required.

AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY

Economic theory and the natural science point of view, M. A. Copeland (*Amer. Econ. Rev., 21 (1931), No. 1, pp. 67–79*).—This paper, presented at the forty-third annual meeting of the American Economic Association, Cleveland, Ohio, December 30, 1930, considers how standards of social policy, the marginal utility theory and the ultimate determinants of price, the law of supply and demand, the productivity theory, Say's law that real supply is real demand, and theory of taxation might be treated from a natural science point of view.

Manual on research and reports (*Baltimore: Williams & Wilkins Co., 1931, pp. 108*).—This manual, issued by the Committee on Research of The Amos Tuck School of Administration and Finance, has special application to the field of business, economics, and public affairs. It covers the outline of the problem; surveying the available material; gathering, recording, and organizing information; analyzing and interpreting the data; and the preparing of the report.

[Investigations in agricultural economics at the Alabama Station, 1929–30] (*Alabama Sta. Rpt. 1930, pp. 7–9*).—Data collected by J. D. Pope and C. M. Clark from 1,225 farmers in 6 counties showed that the yield per acre of cotton was more important than the length of staple in determining gross receipts per acre.

An economic study of poultry and cotton farming in Marshall and DeKalb Counties by C. G. Garman showed that the average annual production, 1927–1929, of commercial poultry flocks averaging 170 layers was 144 eggs per bird, the average cost of production being 24.5 cts. per dozen, the average profit 6.1 cts. per dozen, and the average return for labor $225 per farm. Farms with commercial flocks as a side line to cotton had an average labor income of $320, as compared with $36 for farms with small poultry flocks. Farms with an average yield of less than 300 lbs. of lint cotton had a labor income of $58, and those with a yield of 400 lbs. and over of cotton, $529. Farms with less than 13 acres in cotton had an average labor income of $158, and those with over 20 acres in cotton, $360. Farms with receipts of less than $50 from miscellaneous sources had an average labor income of $210, and those with miscellaneous receipts of $50 and over, $380. Men using 2-horse cultivators averaged 48 man hours per acre of cotton and had an average labor income of $329, while those not using 2-horse cultivators spent 66 man hours per acre and had an average labor income of $243.

A study in 1927 and 1928 by Pope of the organization of farms in the peanut area of the State with reference to hog production showed that (1) with increase in size of farm, the size of the hog enterprise did not increase proportionately and the percentage of crop acreage in peanuts decreased; (2) as the acreage in peanuts increased, the percentage sold for cash increased; (3) there was no great difference in the receipts per acre from peanuts sold for cash and sold through hogs; and (4) the average cost per 100 lbs. of producing pork was $6.59 in 1927 and $7.62 in 1928, there being a profit of 15 cts. per 100 lbs. in 1927 and a loss of 38 cts. per 100 lbs. in 1928. The distribution of the cost of production of pork for the two years was: Fattening crops, mostly grazed peanuts, 52 per cent; farm-grown, hand-fed feeds, mostly corn, 30 per cent; purchased feeds, 4 per cent; pasture and grazing crops, 4 per cent; labor, 9 per cent; and other feed crops, 1 per cent.

[Investigations in agricultural economics at the Florida Station, 1929–30], C. V. Noble (*Florida Sta. Rpt. 1930, pp. 27–32*).—A comparison is made of the records for 1925 and 1928 of 110 farms in the general farming region of northwest Florida. The total capital, receipts, and expenses were less in 1928 than in 1925. The average farm income and labor income of operator were $737 and $231, respectively, in 1925, and $217 and —$269, respectively, in 1928.

A study made in cooperation with the Bureau of Agricultural Economics, U. S. D. A., of 1,709 bales of cotton ginned in three areas of the State from August 23 to November 30, 1928, showed approximately 67 per cent of the cotton to be white and 33 per cent to be spotted, and that 19 per cent was untenderable on contracts. Of the white cotton, 21 per cent was above middling, 46 per cent middling, and 33 per cent below middling. Of the spotted cotton, 40 per cent was above middling, 45 per cent middling, and 15 per cent below middling. The average value (1,569 bales) in the central markets was $1.89 per bale less than basis, white middling ⅞-in. staple. The local buyers paid an average of $1.26 less per bale than for base grade and staple. The average spreads per bale in the three areas were $3, $3.57, and $8.14, averaging $3.80 for white cotton, and $2.58 and $7.60, averaging $6.33, for spotted cotton

in two areas. There was a decided tendency for the spread to widen as the quality of grade and staple increased. Growers were paid or penalized only a part of the central market premiums and discounts for grade and staple, the local buyers going about 33 per cent of the distance toward buying on the basis of quality.

Data collected regarding shipments of truck in the 1928–29 season showed that watermelons, celery, lettuce, cabbage, cucumbers, and potatoes were moved almost exclusively by car-lot freight. Express and boat movements represented the following percentages of the total movements for other crops: String beans, 41; eggplants, 39.3; peppers, 29.9; strawberries, 24.8; and tomatoes, 18.2.

[Investigations in agricultural economics at the Ohio Station] (*Ohio Sta. Bimo. Bul. 150 (1931), pp. 112–119, figs. 4*).—A summary by H. R. Moore entitled Farm Taxes describes briefly (pp. 112, 113) the increase from 1920 to 1930 in the percentage of net cash agricultural income in Ohio paid for taxes and the cost of the periodic general reappraisement of tax valuations in the State.

Under the title Corn and Hay Yields for 1930 (pp. 113–115), a table and maps prepared by R. E. Straszheim show the rainfall in Ohio, by months, 1930, and the average, 1883–1930, and the yields, by counties, 1930, and the average, 1920–1929, of corn and tame hay.

Under the title Wheat and Bread Prices (pp. 116, 117), a chart prepared by J. I. Falconer shows the level of the average farm price of all wheat in the United States, of industrial wages, and of bread, by years 1913 to date. Population Changes, 1920 to 1930, by the same author (pp. 117, 118) shows by map by counties the percentage population changes during the period named.

Under the title Index Numbers of Production, Prices, and Income, the table by Falconer (E. S. R., 64, p. 891) is brought down through February, 1931.

[Investigations in agricultural economics at the Wisconsin Station, 1929–30] (*Wisconsin Sta. Bul. 420 (1931), pp. 56–65, figs. 3*).—A study made by G. S. Wehrwein and K. H. Parsons of the status and possibilities of recreation as a land use in Oneida and Vilas Counties showed 10 per cent of the taxable area in Oneida County and 25 per cent in Vilas County to be assessable as suitable for recreation purposes, one-half and almost two-thirds, respectively, of these areas being already in use for these purposes. These areas represented over 37 per cent in Oneida County, exclusive of the city of Rhinelander, and over 50 per cent of the assessed valuation of the real estate in Vilas County. There was very little tax delinquency on recreational land. The increased demand for foods and services due to summer visitors is discussed briefly.

A table is included and briefly discussed showing the average value of goods and services used by 120 Dunn County and 118 Walworth County farm families during the year 1928–29. This table is based on data obtained in a study made by E. L. Kirkpatrick, J. H. Kolb, P. E. McNall, and M. L. Cowles, in cooperation with the U. S. D. A. Bureau of Agricultural Economics, of approximately 1,000 farm families in 7 counties. The average value of goods and services was $1,536 for Dunn County and $1,730 for Walworth County. In Dunn County 18 families lived on less than $900 per year and in Walworth County 6 families. Eight families in Dunn County and 17 in Walworth County used over $2,400 worth of goods and services. Nearly one-fourth of the farm homes in Dunn County were classed as modern on the basis of home conveniences. Size of house seemed to depend on size of family rather than on amount of annual income. Modern conveniences were found to vary in almost direct proportion to size of annual income. Compared with urban families with like incomes, the rural home represented less utilization of

modern conveniences. As to other housing facilities, the rural homes compared favorably.

A study made by McNall and D. R. Mitchell of 165 farms in 3 areas of the State showed that on the average dairy farm of 80 acres in crops and 17 cows the farm operators worked an average of 3,323 hours per year, other members of the family 1,664 hours, and hired help 1,694 hours. The operators averaged 67 hours per week in the summer and 62 hours in the winter. Operators using tractors worked slightly longer hours than did those not using tractors, but cared for, on an average, 17 acres more of crops and milked 4 more cows.

In a study made by M. A. Schaars, it was found that in 1929 38 per cent of all fluid buttermilk produced in the State was dried and that approximately 28 per cent was powdered. Detailed data from 18 plants drying buttermilk only showed the average production to be 189,483 lbs. Few creameries making less than 500,000 lbs. of butter and receiving cream only, dried the buttermilk. Powder sales netted an amount sufficient to defray from one-fourth to one-half of all creamery operating costs, including drying costs, but excluding hauling costs of milk and cream. Creamery operators estimated that drying buttermilk permitted the payment of about 1 ct. per pound additional for butterfat. The survey showed that for 11 plants the net gain on powdering was 0.8 ct. per pound of butterfat.

In 22 creameries in 1929, 60 per cent of the butterfat was received in whole milk deliveries. Farmers received from 8 to 10 cts. per lb. more for butterfat delivered in whole milk than for that delivered in cream. The creameries produced an average of 447,172 lbs. of skim milk powder. Drying skim milk enabled the creameries to offer services equal to those of whole milk competitors, to provide a market for all skim milk sold, to make fuller use of labor and capital, to regain patrons who did not desire to produce cream, and to get a better quality of cream.

The location of 165 casein drying plants in the State, a relatively recent development, has followed the American cheese producing area rather than the butter areas. The production averaged 73,960 lbs. for 144 plants. Relatively small whole milk creameries found it advantageous, because of the small investment required to install casein rather than skim milk drying apparatus.

Dairy marketing surveys by R. K. Froker and H. T. Sondergaard showed that milk from 85 per cent of the territory served by 102 cheese factories in Shawano County is hauled by truck to large milk plants, and that 16 of the 33 factories operating in 1921 in Langlade County were not operating in 1929.

Agricultural economics, C. S. ORWIN (In *Agricultural Research in 1929. London: Roy. Agr. Soc. England, 1930, pp. 63–82*).—Short summaries are given of the research work in England during the year in dairying, beef, sheep and wool, sugar beets, celery, fruit, horses and machinery, small holdings, cooperation and marketing, and economic conditions and policy. Methods of research are discussed, and a list is given of publications during the year.

The Farm Board: Its general policies and work in helping agriculture, J. C. STONE (*Fed. Farm Bd. Circ. 3 (1931), pp. 8*).—This is a brief statement of the general policies and work of the Federal Farm Board.

Crop and livestock production trends (*U. S. Dept. Agr. Yearbook 1931, pp. 559–578, figs. 26*).—Charts are included showing for the United States for the period 1890–1930, so far as statistics were available, the acreage, production, and yield per acre of the more important crops; the population, number of farms, and land in farms; cattle, hogs, and sheep and lambs slaughtered under

Federal inspection; number of sheep and lambs and horses and mules on farms; the production of farm and factory cheese and butter; and the number of chickens and production of eggs (1880–1925). Some charts are also included showing data as to acreage, production, and yields in different areas of the United States, for production in foreign countries, and for exports from and imports into the United States.

A farm business survey of the early potato section of Virginia, 1928 season, E. Rauchenstein and J. J. Vernon (*Virginia Sta., 1930, pp. [13], fig. 1*).—In this mimeographed report of a study made in cooperation with the Bureau of Agricultural Economics, U. S. D. A., tables are included and discussed analyzing data obtained in July, 1929, by interviews with 169 farmers in Northampton and Accomac Counties and the Norfolk area regarding the production of potatoes and other crops, livestock and poultry, and expenses and incomes of the farmers.

A farm business survey of the early potato section of Virginia, 1929 season, J. J. Vernon and E. Rauchenstein (*Virginia Sta., 1930, pp. 23, fig. 1*).—This is a continuation of the study noted above and is based on data obtained in 1930 from 143 of the 169 farmers included in the previous report. Some comparisons of the 1928 and 1929 results are included.

An economic survey of the Los Angeles milk market, L. Spencer (*California Sta. Bul. 513 (1931), pp. 106, figs. 10*).—This study is limited to Los Angeles County and the sources of milk and cream for that county. Particular attention is given to the surplus problem and the relations between producers and distributors. No data were collected on costs of production or of distributing milk.

The data were collected from records and by interviews with officials of various associations, the Los Angeles City and County Departments of Health, and the State Bureau of Dairy Control. A 13-months record of the supply and utilization of milk and cream was compiled from the records of the leading milk distributors, a cooperative plant, and country plants shipping sweet cream to the Los Angeles market. The *consumption of milk and cream; grades and sanitary control*; supply and utilization of milk, cream, and skim milk; the sources of milk fat in ice cream; the transportation and distribution of milk and cream in the area studied; and the prices and margins of milk are discussed. The dairymen's organizations and the Cooperative Dairy Products Association, Ltd., organized in January, 1930, to operate a surplus milk plant are described.

Recommendations are made in regard to regulating the buying price of milk, adjustment of the supply, adjustment of wholesale and retail prices, milk inspection, and the reorganization of the present dairymen's organizations and the services that should be rendered by such organizations.

Report of the royal commission investigating the apple industry of the Province of Nova Scotia, H. M. Tory et al. (*Halifax: Min. Pub. Works and Mines, 1930, pp. 71; Sup., pp. 52*).—These are reports of the royal commission appointed in 1930 to investigate the industry and make recommendations for its improvement. The main report covers the status of the industry, costs of production, transportation charges, financing, and marketing under present conditions, and methods of dealing with the problems of financing and marketing in other countries. The supplementary report deals more fully with the scientific problems of by-products, precooling, fertilization, cultivation, cold storage, transportation temperatures, and the organization of scientific work.

Wheat in Canada, L. d'Hautreserve (*Le Blé au Canada. Paris: J.-B. Baillière & Sons, 1931, pp. [1]+184+[1], pls. 4, figs. 12*).—A description of the production, storage, and transportation of Canadian wheat and of the operation of wheat pools in that country.

Russia and the United States in the world's wheat market, C. F. MARBUT (*Geogr. Rev., 21 (1931), No. 1, pp. 1–21, figs. 10*).—This paper describes the soil and the climatic and transportation conditions favoring wheat growing in the two countries, and discusses the relation of the conditions in Russia to the agricultural part of the five-year plan of the U. S. S. R. The author concludes that allowing for all eventualities that seem to be reasonably justified, it may be safely assumed that Russia will be able to export in 1933 "more than the maximum amount exported in any year before the war."

Wheat: Cost of production, 1923–1930, compiled by L. O. BERCAW (*U. S. Dept. Agr., Bur. Agr. Econ., Agr. Econ. Bibliog. 33 (1931), pp. II+33*).—This is a mimeographed annotated bibliography including general references and references to the United States and State publications and to some publications of foreign countries.

Outlook for American cotton (*Fed. Farm Bd. Bul. 4 (1930), pp. I+26, figs. 19*).—"It is the purpose of this publication to discuss the outlook for cotton in 1931, from a national and international standpoint, in order that cotton growers may adjust the acreage of their cotton crop and their production of livestock in 1931 so as to obtain the greatest possible net income."

Cotton price-quality relationships in local markets of Louisiana, C. C. FARRINGTON (*Louisiana Stas. Bul. 221 (1931), pp. 59, figs. 8*).—Data for the 1928–29 ginning season regarding prices, buyers' grade and staple designations, freight rates, shipping destinations, facilities, practices, charges, etc., from 10 local markets in Louisiana representative of different types of buyers' markets were obtained by personal visits to cooperating gins by representatives of the station and the Bureau of Agricultural Economics, U. S. D. A. The markets differed from each other more or less, but are classed in two general groups, (1) commission markets, including five markets in which all or most of the cotton was purchased on a cash basis either by buyers working on a commission basis for a central merchant or firm or by independent buyers, and (2) five merchant markets where all or most of the cotton was purchased or taken on account by merchants or ginner merchants who had furnished the farmers food, clothing, and supplies. The premiums and discounts for staple length and grade differences in the individual markets and groups, the spread between central and local market prices, and the variations between price and quality for individual bales in the same markets during the same day are analyzed and discussed. A comparison is made of the classification given bales by the Government classers and by local buyers.

The average premiums and discounts per bale from the price for 7/8-in. staple and for other staple lengths in the New Orleans spot market were for 13/16 in. and less −$2.50, 15/16 in. +$1.35, 1 and 1 1/32 in. +$4, 1 1/16 and 1 3/32 in. +$6, 1 1/8 and 1 5/32 in. +$10.70, and 1 3/16 and 1 7/32 in. +$15; in the commission markets (prices adjusted for the average spread between local market and New Orleans spot market prices and freight and compressing charges to the New Orleans spot market) −50 cts., +65 cts., +$1.95, +$3.55, +$6, and +$7.30, respectively; and in the merchant markets (prices adjusted) −20 cts., −60 cts., −15 cts., −35 cts., −$1.05, and −80 cts., respectively. The average deviations per bale in the prices of different grades (white) from the price of middling cotton in the central markets were for strict good middling +$2.95, good middling +$2, strict middling +$1.25, strict low middling −$3.60, low middling −$6.35, and strict good ordinary −$9.85. The average deviations in the commission markets were +$1.20, +55 cts., +70 cts., −$1.80, −$5.30, and −$1.40, respectively; and in the merchant markets, no strict good middling, +65 cts., +35 cts., −45 cts., −60 cts., and −$1.45, respectively. The average spreads per bale between central market and local market prices (adjusted for differences in freight and

compressing charges) in the commission and merchant markets for different staple lengths were, respectively, $\frac{13}{16}$ in. and less −$2.45 and −$1.30, $\frac{7}{8}$ in. −45 cts. and +$1, $\frac{15}{16}$ in. +25 cts. and +$2.95, 1 and $1\frac{1}{32}$ in. +$1.60 and +$5.15, $1\frac{1}{16}$ and $1\frac{3}{32}$ in. +$4 and +$9.35, $1\frac{1}{8}$ and $1\frac{5}{32}$ in. +$4.25 and +$12.75, $1\frac{3}{16}$ and $1\frac{7}{32}$ in. +$7.25 and +$16.80, and all lengths +$1.40 and +$3.25.

A direct relationship was noted between the average spread between local and central market prices and the average staple length produced in the community. In the commission markets the spread was relatively narrow during the middle of the season and wider at the beginning and the end, especially the latter, the change being due to the volume of business. In the merchant markets the spread was very wide at the beginning of the season and narrowed as the season advanced, the change being due largely to the decrease in the average length of staple. Market facilities available, such as warehouses, had an appreciable influence on local prices. Some buyers reported no loss in the average weight of bales between local and central markets. Others reported a loss as high as 10 lbs. per bale. Data secured at one market showed a loss of nearly 6 lbs.

An analysis of the individual transactions for one day showed numerous inconsistencies and irregularities in the prices paid for the same grade and staple length in the commission markets. In the merchant markets about the same price was paid regardless of quality or any other consideration.

A definite tendency was apparent for local buyers to call practically all cotton 1, 2, or 3 of the middle grades and staple lengths. The Government classers usually made a more or less normal distribution throughout the range of grades and staple lengths.

From the study it seems apparent that the type of buyers and degree of competition are very important factors affecting price-quality relationships and average price levels, and that comparability and uniformity of classification are prerequisites for an accurate reflection of quality values to farmers.

Variations in local prices for farm products and supplies in Missouri, F. L. Thomsen (*Missouri Sta. Research Bul. 151 (1930), pp. 59, figs. 16*).—This study was made to discover the extent of the variations in local prices for farm products and farm supplies, to measure the influence of some of the more tangible factors responsible for the variations, and to test the reliability of the "farm price" data collected by the Missouri Cooperative Crop Reporting Service of the Bureau of Agricultural Economics, U. S. D. A., and the Missouri State Board of Agriculture. Special local price reports covering the year 1927 were obtained from individual dealers for shelled corn, soft wheat, oats, flour, shorts, tankage, bran, superphosphate, butterfat, eggs, heavy hens, light hens, fryers, heavy male birds, butcher hogs, fat lambs, good butcher cattle, and veal calves. The reports were collected by local advanced high school students. At least one report was received from 316 towns, and 189 towns had 12 reports on at least one commodity. The average number of towns reported per month was 309, and the average number of reports per month was 629.

Comparisons of the two price series indicated that for most commodities the regular quotations of the Missouri Cooperative Crop Reporting Service are reliable indicators of price movements for the State as a whole. Correlation between the two series for individual towns showed a fairly high degree of association. The averages for small areas like counties, and in some cases districts, were believed not to be reliable. The analysis of variations in price between towns indicated that the popular conceptions of such differences are greatly exaggerated. A fairly well defined degree of negative association was found to exist between prices of farm products and those of supplies. There

was a fairly distinct tendency for towns with high or low prices for one farm commodity to be the same for other products.

A study of the effect of freight rates on local prices indicated that on the whole they are fully reflected in such prices, but with great unevenness as between individual commodities and towns.

Regional differences in local prices in the case of some commodities were found to correspond fairly closely with expectations based on a qualitative analysis of conditions. In other cases there appeared to be no logical basis for sectional differences in prices.

Except for some commodities like corn and oats, local production had no well-defined influence on local prices. Prices of farm products were slightly lower and those of supplies slightly higher in inland than in railroad towns. Size of town had little or no effect on prices until a population of 5,000 was reached, when generally prices of farm products were higher and those of supplies lower. Farm products prices were no higher and those of supplies no lower in towns with cooperative agencies than those with private dealers only. Prices paid or received by different dealers in the same town were uniform about 38 per cent of the time, and where there were variations they were usually small. Little relation was found between number of local dealers and local prices.

Crops and Markets, [May, 1931] (*U. S. Dept. Agr., Crops and Markets, 8 (1931), No. 5, pp. 161–200, figs. 3*).—Included are tables, graphs, reports, notes, and summaries of the usual types, and tables showing the unloads during 1930 of 19 fruits and vegetables in 66 cities and the indexes, by States, of the estimated values of farm real estate per acre, March 1, 1931, with comparisons with certain previous years.

Agricultural statistics (*U. S. Dept. Agr. Yearbook 1931, pp. 579–1090*).—Current statistics and summaries for 1930 as noted for 1929 (E. S. R., 63, p. 388) are presented covering grains, cotton, sugar, tobacco, fruits, vegetables, miscellaneous crops, beef cattle, hogs, sheep, horses, mules, asses, honey, dairy cattle and dairy products, poultry and poultry products, foreign trade in agricultural products, farm business, and miscellaneous items.

Economic relationships and social conflict, C. R. Hoffer (*Michigan Sta. Quart. Bul., 13 (1931), No. 3, pp. 165, 166*).—"The conflict described in this paper occurred in a progressive rural community in 1920 and the following years. Outwardly there was no sign of trouble, but close acquaintanceship with the community revealed the fact that farmers were antagonistic toward business men in the town. The causes of this antagonism appeared to be: (1) The emotional tension created by the agricultural depression; (2) a disparity in the decline of prices of agricultural products and of merchandise; (3) a prejudice in favor of farmers on the part of the county agricultural agent; (4) the development of interests and programs in the town independently of the rural territory around it; (5) the expansion of the Chamber of Commerce program. The issues in this conflict were not brought to a definite head. Instead, farmers avoided contact with business men whenever possible and community leaders tried to keep this action on the part of farmers out of public discussion. In time, however, one group of professional men, the physicians, were involved in the conflict mainly because they decided to make a transportation charge in addition to fees for professional calls in the country.

"An analysis of this situation suggests that conflicts in rural communities may be divided into two types: the active and the passive. Those belonging to the first type are dramatic and intense, whereas those belonging to the second type have the opposite characteristics. The circumstances in the community under consideration suggest further that conflict is likely to arise between

farmers and business men when a town in rural territory becomes large enough to have interests and programs not directly related to the remainder of the community. These interests probably do not become significant until the town has a population of approximately 5,000. Finally, the turn of events in this community illustrates the fact that emotion and prejudice associated with conflict are necessarily more ephemeral than mutual relationships existing between groups in a community."

AGRICULTURAL AND HOME ECONOMICS EDUCATION

Methods and status of scientific research, W. E. Spahr and R. J. Swenson (*New York and London: Harper & Bros., 1930, pp. XXI+533*).—"This book is designed for the beginner in research, particularly for college seniors and for those who are expecting to engage in research leading to the master and doctorate degrees in the social science fields. The work has been planned to provide the novitiate in research with the three most valuable tools necessary to successful research, (1) the principles of critical scholarship which appear to be most generally acceptable among the leading scholars of the world, (2) the proper technique to be used in applying the principles of scientific method, and (3) a general knowledge of the status of research to-day in those fields in which the social scientist does the major part of his research. Above all it is the purpose of this book to give the beginner in research that proper attitude of mind without which he can not hope to produce scholarly results."

The several chapters deal with the implications of scientific method in research; qualities and aptitudes demanded of the scholar; rewards and punishments in research; critical analysis of the nature and authorship of sources; internal criticism; gathering data; the use of the general library; the use of a law library; gathering data outside of libraries; classifying, analyzing, and interpreting the data; the preparation of the manuscript; some standard practices in writing; plagiarism, copyright, and publication; international research; Federal, State, and municipal research; councils, learned societies, universities, and foundations in research; and industrial, commercial, and social research.

Effect of vocational agriculture training upon work in college, R. E. Singleton (*Agr. Ed.* [*Des Moines*], *3* (*1931*), *No. 12, pp. 183, 196, figs. 2*).—This article reports the results of a study of the scholastic attainments of all students enrolling as freshmen during the fall and winter semesters in the College of Agriculture of the University of Missouri from 1925–26 to 1929–30, inclusive. Of the number, 171 presented one or more credits in vocational agriculture for entrance and 255 presented no credits in this field. An analysis was made to show the relative college grades received by each group, the ultimate outcome of their college attendance, and the opinion obtained by questionnaires of 100 of those who presented vocational credits as to the value of such training as a preparation for attendance in the College of Agriculture.

The average weights of grades were 2.11 for the nonvocational group and 2.25 for the vocational group. The averages for those presenting different amounts of credit in vocational agriculture were for 6 units, 2.24; 5 units, 2.42; 4 units, 2.28; 3 units, 2.11; 2 units, 2.08; and 1 unit, 1.5. Of the vocational group, 12.8 per cent received degrees and 31 per cent were still in attendance, 14.6 per cent had been suspended, and 2.2 per cent had changed to other schools, as compared with 9, 29, 19.6, and 6.6 per cent, respectively, for the nonvocational group. Of those answering the questionnaire, 95.6 per

cent believed that technical agriculture courses in college were made easier by high school vocational agriculture courses. Related science courses were believed to have been made easier by 45.4 per cent and not affected by 54.5 per cent. Academic courses were believed to have been made easier by 22.7 per cent, not affected by 59 per cent, and made more difficult by 18 per cent.

Cooperative extension work, 1929 (*U. S. Dept. Agr., Coop. Ext. Work 1929, pp. 137, figs. 27*).—This report of cooperative extension work in agriculture and home economics of this Department and the State agricultural colleges and the University of Hawaii covers the year ended June 30, 1929, as regards funds, and the calendar year 1929 as regards results of work.

The funds and staff; extension studies and teaching; methods of teaching; information and visual instruction; methods and results of county agricultural agent, home demonstration, and boys' and girls' 4-H club work; extension work with negroes; farmers' institutes; and the economic results of extension work are described and discussed. Pages 93-137 are devoted to statistical tables.

FOODS—HUMAN NUTRITION

The use of honey in water-ices and sherbets, H. A. Smallfield (*Sci. Agr., 11 (1931), No. 5, pp. 259-264*).—The author has demonstrated that honey in suitable amounts prevents the crystallization of sucrose in water ices. A combination of 22 per cent sucrose and 8 per cent honey gave the most desirable results. A trial of various grades of honey at this concentration in the manufacture of orange ice showed that the flavor was more satisfactory with the golden grade. This grade of honey was also satisfactory in ices of other flavors. A trial of various grades of honey in sherbet mixes containing milk to the extent of 50 per cent did not give satisfactory results. At prevailing prices the increased cost of using the honey and sucrose mixture in place of all sucrose amounted to approximately 1.5 cts. a gallon.

Home canning of meat under conditions in Louisiana, G. Sunderlin (*Louisiana Stas. Bul. 220 (1931), pp. 8*).—This is the complete report of an investigation the general scope and preliminary results of which have been noted previously (E. S. R., 63, p. 389). The same plan was followed in the second season as in the first, except that the meat had been in cold storage not more than 4 days when canned instead of being canned within 24 hours after killing, and that the tin cans were sealed with lids having paper instead of composition gaskets. The meat included 395 lbs. of beef and pork canned in 1929 and 384 lbs. canned in 1930.

In the 1930 supply no spoilage occurred in any of the 192 cans and spoilage in only 2 of the jars. This spoilage occurred in 2 jars of beef processed for 3 hours in the boiling water bath and stored in the basement. The spoilage was shown by bacteriological tests to be due to underprocessing rather than leaks or imperfect seals.

The findings for both seasons would seem to indicate that meats can be canned as well in glass as in tin. Although there was no spoilage due to underprocessing in the cans or jars processed 4 hours in the boiling water bath, this method "is not recommended in this climate because of the possibility of poisoning from botulism."

Determination and identification of organisms which cause the spoilage of canned vegetables in the South, O. D. Abbott (*Florida Sta. Rpt. 1930, pp. 74, 75*).—This progress report (E. S. R., 63, p. 691) deals with a further study of the nongas-forming organism previously shown to be responsible for one form of spoilage in incompletely sterilized canned corn. In this form of spoilage the cans do not swell, but the corn becomes soft, packs in the jars,

and shows hydrolysis of starch. The organism is said to have most of the characteristics of *Bacillus graveolens* and to belong to the *B. subtilis* group. If the corn is packed in the jars in the proportion of 4 or even 3 parts of corn to 1 of water, the organism is not always killed after the jars have been autoclaved at 240° F. for from 60 to 75 minutes. The resistance of the organism is attributed to the resistance of its spores in colloidal substances. It has been found that the spoilage can be prevented by adding tartaric, acetic, hydrochloric, or phosphoric acid to the corn in such proportions that the pH of the water added becomes 2.4 to 3.

The physiological effects of diets rich in egg white, H. T. PARSONS (*Jour. Biol. Chem., 90 (1931), No. 1, pp. 351–367, figs. 2*).—This investigation, in which the author had the cooperation of E. Kelly, was occasioned by the unsatisfactory results obtained by Parsons et al. (E. S. R., 64, p. 290) in the use of cooked, dried, and commercial egg white as a source of protein in high protein diets. In the present study the egg white employed included both a commercial dried Chinese product and egg white from fresh eggs. In most of the rations it was fed in a dry powdered form, but in some it was fed cooked in various ways. The egg white for the most part constituted 66 per cent of the diet, which contained in addition dried yeast, wheat embryo, sugar, salt mixture, and in some cases a supplement of dried cooked beef liver. The same technic was employed in the care and handling of the rats as in the previous investigation.

Young rats weaned from stock rations and fed rations high in egg white rarely survived more than a few days. "The symptoms noted were loss of weight, lessened activity, an awkward gait in walking, a humped back, meteorism, increased shedding of hair, soiled fur, paws, and tail, closed eyelids, and bloody urine. The rats were often found dead with the jaws firmly closed on the wire mesh of the floor of the cage or in other attitudes suggesting extreme spasticity. On autopsy the bladder was frequently found to be filled with bloody urine or drops of dried blood were found on the paper under the floor of the cage. The cecum and sometimes the small intestine and stomach were filled with a greenish black, foul smelling mass."

Rats which had come from stock on a diet containing liver were able for the most part to survive the first acute injury, but later developed skin and nervous manifestations strikingly like those of human pellagra. The paper should be consulted in the original for a description of these symptoms and illustrations of the rats in this condition. The pellagra-like symptoms could be prevented or cured by 20 per cent of dried beef liver but not by 10 per cent. Lard and raw linseed oil were ineffective either in preventing or curing the symptoms, thus showing that the condition was not due to a deficiency in unsaturated fatty acids, as suggested by Burr and Burr for a similar condition noted by them (E. S. R., 63, p. 595).

In discussing the significance of this pathological condition the author is inclined to the view that complex dietary relationships such as unusual vitamin requirements on the particular diet or lessened absorption or utilisation of a vitamin "might perhaps furnish as tenable hypotheses as postulating a new deficiency disease to account for the symptoms which so strikingly resemble pellagra in the present experiment."

The results are considered to be of practical importance as confirming Bateman (E. S. R., 35, p. 861) "in suggesting caution in the use of as large quantities of raw egg white in invalid feeding as has been the common practice in many hospitals in the past. Furthermore, the fact that many cases of eczema in children have been observed to be associated with a sensitization to egg white raises the question as to whether the early introduction of egg white into the

somewhat restricted dietary of the child may perhaps need to be safeguarded with protective foods in somewhat the same way as its introduction into the diet of the rats in the present experiment."

Mammalian carbohydrate metabolism, C. F. Cori (*Physiol. Rev., 11 (1931), No. 2, pp. 143–275, figs. 2*).—An extensive review of the literature on the subject, with a bibliography of over 450 references.

[Calcium studies at the Wisconsin Station] (*Wisconsin Sta. Bul. 420 (1931), pp. 77–79*).—Using rats as experimental animals, H. Steenbock and associates have demonstrated that the optimum amount of calcium in the ration is from 0.5 to 1 per cent expressed as calcium carbonate. They have also shown that calcium sulfate and calcium chloride are as efficient and satisfactory sources of calcium as calcium carbonate.

The theory advanced by Mellanby (E. S. R., 56, p. 92) concerning the presence in certain foods of a factor interfering with the normal process of calcium assimilation in the body has received support in studies by Steenbock and S. W. Kletzien. "By subjecting rolled oats, wheat, corn, and rice (known carriers of the mysterious decalcifying substance) to heat treatment, such as employed in the manufacture of puffed wheat, puffed rice, etc., the calcifying properties are improved. Cooking of these foods also improved their quality in this respect. Some other foods, such as tapioca, carrots, white potatoes, dasheens, and sweetpotatoes, are improved also in their calcifying action in the body by digestion with dilute hydrochloric acid." The decalcifying factor is concentrated in wheat germ oil and present in large quantities in wheat gluten. Attempts to isolate the factor have thus far been unsuccessful.

The general belief among nutrition workers that fats may interfere in some way with calcium assimilation in infants through the formation of insoluble calcium soaps which are excreted in the feces has been tested by Steenbock and Kletzien by comparisons of the bones of rats on diets of equal caloric value but high in fat and in carbohydrate, respectively. No significant differences in the calcium content of the bones could be detected after 5 weeks on the experimental diets.

Studies by J. H. Kellerman in cooperation with Steenbock have suggested that the calcium soaps which are excreted in the feces of infants are due to deficient fat assimilation rather than nonavailability of the calcium soaps. No differences were found in the availability and assimilation of calcium when fed as calcium stearate, calcium oleate, or soaps prepared from cottonseed oil and tallow as compared with pure calcium salts such as calcium carbonate, lactate, and citrate.

The manganese metabolism of the rat, J. T. Skinner, W. H. Peterson, and H. Steenbock (*Jour. Biol. Chem., 90 (1931), No. 1, pp. 65–80*).—The experiments reported consisted of "(1) determination of the manganese content of the whole animal at different ages when given a complete ration and when this was supplemented with manganese, (2) analysis of the various tissues of rats receiving a complete ration with and without manganese additions, (3) a study of the metabolism of manganese by animals on a high and low intake of the element, and (4) determination of the manganese content of the whole animal on an incomplete ration and on the same ration when supplemented with manganese or combinations of this element with copper and iron."

All of the animals taken for analysis were carefully washed with distilled water to remove any traces of adhering manganese, the intestines were removed from all animals 21 days old or over and the bodies dried in the steam oven at 100° C. The manganese determinations, with the exception of a few in which the Official method was used, were made according to the procedure previously noted (E. S. R., 65, p. 12).

In rats on the stock ration described by Waddell and Steenbock (E. S. R., 61, p. 95), the total amount of manganese increased from 0.0015 mg. at birth to 0.0676 mg. at 180 days of age. The percentage concentration was highest at birth, decreased during the first 12 days, rose to the second highest peak at 21 days, and decreased thereafter. The manganese content at birth was increased 40 per cent when the mothers received 5 mg. of manganese daily during gestation. During the suckling period the storage of manganese was slow, nor was it increased by additions of manganese to the mother's ration during this period. After the young had begun to eat the mother's ration, a marked increase in manganese storage resulted from added manganese in the ration. The mothers on a high manganese intake were unable after rearing several litters to nourish their young properly.

Analyses of the tissues of mature rats on the stock diet showed the highest content, 6.15 mg. per kilogram, in the liver, followed by the kidney, heart, spleen, and brain, with values between 2 and 3 mg. per kilogram, and still lower values in the lung 1.31, the bone 0.79, muscle 0.56, and hide 0.47 mg. In rats receiving additional manganese the concentration was still highest in the liver, 7.91 mg., representing a 29 per cent increase. The content in the kidneys also increased by 29 per cent, but the greatest percentage increases were in the bones, 191, and hide, 79 per cent.

Adult rats on the stock ration excreted 80 per cent, and on the ration supplemented with 5 mg. of manganese daily 99 per cent, of the manganese in the feces. Rats receiving milk plus manganese showed a marked retention of the element. Young rats on a whole milk diet retained approximately 60 per cent of the manganese ingested over a period of 7 weeks. This retention was decreased by additions of copper and iron either singly or together.

Cereals and vegetables furnish manganese (*Wisconsin Sta. Bul. 420 (1931), p. 76*).—Analyses by J. T. Skinner and W. H. Peterson of a large number of food samples for their manganese content have shown that the chief food sources of this element are cereals and green vegetables. It is estimated that the average daily human diet contains about 0.000088 oz. of manganese.

Copper shows value in treating human anemias (*Wisconsin Sta. Bul. 420 (1931), p. 75*).—It is noted briefly that investigations carried on by D. R. Mendenhall in the child health centers of the Madison Public Health Nursing Association have given confidence that certain secondary anemias in infants will respond to treatment with copper and iron salts. Attention is also called to a report from the General Hospital at Montreal, Canada, to the effect that in several cases of anemia of long standing in adults immediate improvement resulted following the use of copper salts as a supplement to the iron therapy which had previously been ineffective.

The nature of vitamin A (*Wisconsin Sta. Bul. 420 (1931), p. 77*).—Extensive studies by C. A. Baumann and H. Steenbock on the relationship of carotene to vitamin A have shown that any procedure which injures carotene in vegetable sources impairs the vitamin A content of the material to a corresponding degree. Carotene prepared from dried carrots by 20 precipitations with methyl alcohol from a chloroform solution had a melting point of 281° F. and was many times richer in vitamin A than a crude solution of carrot. Exposure of this pure carotene for one-half hour to ultra-violet radiations from a quartz mercury vapor lamp destroyed both the carotene and the vitamin A potency, but crude impure carotene obtained with various solvents from dried carrots was entirely stable, both as to color and vitamin A, when exposed to the ultra-violet lamp for five hours. Lycopin, a compound of the same chemical formula as carotene but different arrangement in the molecule, was inactive as a source of vitamin A.

Tomato pulp very rich in vitamin A (*Wisconsin Sta. Bul. 420 (1931), pp. 76, 77*).—It has been found by H. Steenbock and I. M. Schrader that the vitamin A content of tomato juice is concentrated in the pulp portion rather than the clear yellow serum of the juice, and that this pulp makes an excellent source of vitamin A free from vitamin D. If it is desired to have tomato pulp serve as a source of vitamin D as well as A and C, this can be accomplished by adding to the concentrated pulp a small amount of highly concentrated irradiated ergosterol. The pulp thus fortified has been found to retain its vitamin D potency when stored at 98° F. for a year at the natural acidity of the juice, which in this particular case was pH. 5.77.

Vitamin B "complex" in a concentrated aqueous liver extract, A. CHANUTIN (*Va. Med. Mo., 57 (1931), No. 10, pp. 637, 638, fig. 1*).—A commercial liver extract, 1 oz. (or 30 cc.) of which is claimed to be the equivalent of 0.5 lb. of raw liver in the treatment of pernicious anemia, was tested for the vitamin B complex by the method of Sherman and MacArthur (E. S. R., 57, p. 895), with results indicating the minimum maintenance dose to be about 0.5 cc. In comparison with other sources of the vitamin B complex the extract is thought to be many times richer than evaporated milk, skim milk, or tomato juice, and equivalent in an amount of 2 cc. to 200 mg. of dried brewery yeast.

The stability of vitamin G as measured by its growth-stimulating effect, N. B. GUERRANT and W. D. SALMON (*Jour. Biol. Chem., 89 (1930), No. 1, pp. 199–211; abs. in Alabama Sta. Rpt. 1930, pp. 26, 27*).—In this investigation of the stability of the growth-promoting activity of vitamin G in yeast and yeast extracts under various treatments, rats 25 to 30 days of age and averaging 45 to 50 gm. in weight were placed in group cages and fed a basal diet of washed casein 18, salt mixture (186) 3.7, agar 2, cornstarch 69.3, cod-liver oil 2, and butterfat 5 parts. The salt mixture 186 is the McCollum and Simmonds salt mixture 185 with dibasic calcium phosphate substituted for the monobasic phosphate and 0.004 per cent potassium iodide added. After a depletion period of 2 weeks, the animals were placed in individual cages and each was fed in addition to the basal diet 0.05 gm. of activated fuller's earth prepared from an extract of white corn by the method described previously (E. S. R., 61, p. 91). The materials to be tested were fed daily in quantities equivalent to 0.15 gm. of the net solids of the original material, an amount adequate to produce gains of from 12 to 15 gm. per week. The feeding was continued for 8 weeks, and the rates of growth on the original and treated materials were compared.

The extracts were prepared from yeast previously extracted with gasoline by extracting with 51 per cent alcohol (by weight) at the rate of 10 liters per kilogram of yeast, concentrating this extract by vacuum distillation to a volume of about 500 cc. per kilogram of yeast, shaking the concentrate with successive portions of ether to free it from fatty materials, and concentrating in a vacuum still until all the ether had been removed. After aliquots of the final extract had been subjected to the various treatments, the pH was adjusted to about that of the original concentrated extract and the extraction continued at low temperature to a thick sirupy consistency. The concentrate was mixed with a known weight of dry cornstarch, dried at low temperature, ground, and passed through a 40-mesh sieve. The daily dosages of the treated material and the untreated aliquot finished in similar manner were calculated on the basis of net solids in the untreated controls.

Of the various treatments to which the extracts were subjected, autoclaving for 4 hours at 20 lbs. pressure and heating dry yeast at the same temperature for the same length of time destroyed about 20 per cent of the growth-promoting

activity of the material. The passing of gaseous oxygen through a hot concentrated yeast extract for 4 hours had very little destructive effect and similar treatment with gaseous hydrogen sulfide no effect. Although some loss in activity resulted following deaminization experiments, it was concluded that this was due to destruction by heat rather than deaminization of the free amino groups, for when heating was carefully prevented no destruction took place.

Irradiation of concentrated yeast extracts at a distance of 20 cm. from a mercury arc brought about some decrease in growth stimulating effect. This was greater in alkaline than in acid solutions, suggesting that the result was due to the combined effect of the separate action of alkali and irradiation.

Liver extract as a source of vitamins B and G, W. D. SALMON and N. B. GUERRANT (*Science, 73 (1931), No. 1887, pp. 243, 244*).—Using the methol described above, the commercial liver extract No. 343 of the Lilly Company was tested for its content of vitamins B and G. When fed as the source of vitamin G, with vitamin B furnished by an 80 per cent alcohol extract of white corn, 0.1 gm. of the liver extract per day induced normal growth through an experimental period of 9 weeks. On the same amount as the source of vitamin B there was a slight initial increase in weight, followed by a decline in weight and the onset of beriberi, thus showing the extract to be much richer in vitamin G than in B. It is estimated that it contains 4 or 5 times as much vitamin G, but only about one-fifth as much vitamin B, as the sample of brewers' yeast used for comparison. The vitamin B content of the extract compared favorably, however, with that of the pure dried bakers' yeast commonly obtained on the market.

The vitamin B_2-potency of commercial liver extract, B. C. GUHA (*Lancet [London], 1931, I, No. 16, pp. 864, 865*).—This brief note also states that the Lilly commercial liver extract No. 343 is an excellent source of vitamin B_2 and a poor source of vitamin B_1. The extract was found to produce good growth in rats when fed in doses as small as 40 to 60 mg. daily as a supplement to a vitamin B_2-deficient diet, but to produce only subnormal growth when fed as a supplement to a vitamin B_1-deficient diet in doses as high as 120 mg. daily. In curative experiments on rats which had developed skin lesions and a falling off of the long hair without the development of any bare patches on the skin after long subsistence on a vitamin B_2-deficient diet, the liver extract brought about rapid improvement in a few days.

The liver extract is recommended in preference to yeast as a convenient raw material for the concentration of vitamin B_2, and is also suggested as a substitute for yeast for the cure of human pellagra. "As it is not yet clear that pellagra is due to a simple deficiency of one factor, it is suggested, in order to have greater clarity in this domain of research, that the factor which is assayed by means of rat growth tests be called vitamin B_2, while the factor or factors which are specifically concerned with the cure and prevention of experimental pellagra in rats and which are assayed by means of curative and preventive tests, be called the P-P (pellagra preventive) or the A-P (antipellagra) factor. This provisional arrangement would probably prevent some confusion."

Liver extract as a source of vitamins B and G, W. D. SALMON and N. B. GUERRANT (*Alabama Sta. Rpt. 1930, p. 27*).—In addition to the data noted above, it is stated that the commercial liver extract (Lilly's No. 343) when fed as the sole source of both vitamins B and G in 0.2 gm. daily amounts produced slow but continuous gains and prevented the onset of beriberi. Rats receiving 0.1 gm. of liver extract and 0.05 gm. of the authors' standard vitamin B solid (E. S. R., 61, p. 91) made normal gains and appeared normal in every way.

The relation of high-fat diets to the requirement for vitamin B and G, W. D. SALMON and N. B. GUERRANT (*Alabama Sta. Rpt. 1930, pp. 27, 28*).—The theory advanced by Evans and Lepkovsky (E. S. R., 62, p. 293) that fat exerts a sparing action on the antineuritic vitamin B has been tested, using a slightly different technic in that the various vitamin preparations were fed separately instead of being mixed with the basal diet.

On a cornstarch-casein-salt diet containing 30 per cent of lard, rats showed signs of severe digestive disturbances in all cases where some source of vitamin G was not added to the diet. The addition of vitamin B without vitamin G gave even poorer results. With no vitamin B and varying amounts of vitamin G the survival period increased with the amount of vitamin G. The average length of life was 47 days on 0.15 gm. and 56 days on 0.5 gm. of autoclaved yeast per rat per day as compared with from 30 to 35 days with similar amounts of autoclaved yeast but only 7 per cent of fat in the diet. On a diet containing 59.2 per cent of fat, rats receiving 0.15 gm. of autoclaved yeast were in good condition when the experiment was discontinued after 126 days.

"The results to date seem to indicate that only when the major portion of the energy content of the diet comes from fat is there really a significant diminution of the vitamin B requirement. This may indicate that vitamin B functions in the relatively early stages of the conversion of carbohydrate into forms which are metabolizable. The requirement of the rat for vitamin G is not decreased by increasing the fat content of the diet."

A differentiation of the so-called antipellagric factor, vitamin G, B. SURE, M. E. SMITH, and M. C. KIK (*Science, 73 (1931), No. 1887, pp. 242, 243*).—Attention is called to the observations noted on page 495 concerning the irregularities in the time of appearance of dermatitis and of cessation of growth in rats on different diets supposedly deficient in vitamin B_2. The statement is made that the experiments have been repeated with results corroborating the former findings "that there is no relation between failure in growth and the incidence of pellagra-like symptoms in the rat, the dermatitis being prevalent in some animals that make normal growth and absent in others that are first stunted in growth for weeks and months, and that finally collapse following great losses of weight."

Accentuated dermatitis accompanying excellent growth has been found in 6 out of 12 positive controls on rations containing as the source of vitamin G 10 per cent of yeast autoclaved at 20 lbs. pressure for 6 hours, and of vitamin B irradiated rice polishings. This is thought to afford further proof of the nonidentity of the relatively stable growth-promoting factor and the antidermatitis factor. It is suggested that the autoclaving of the yeast may have destroyed the greater part of the antidermatitis factor without injuring the relatively stable growth-promoting factor. The suggestion is made that the letter G be used for the antipellagric factor and F for the growth-promoting factor.

Avitaminosis, I, II (*Arch. Path., 11 (1931), No. 3, pp. 413–424, figs. 3; pp. 425–433, figs. 2*).—Two papers are presented.

I. ***Pathologic changes in nursing and in weaned albino rats suffering from vitamin B deficiency,*** B. Sure, H. S. Thatcher, and D. J. Walker.—This paper deals with the tissue changes in rats resulting from diets deficient in the vitamin B complex and in vitamin B (B_1), respectively, the diets and general technic being the same as in studies noted previously (E. S. R., 59, p. 490; 62, p. 494).

The principal changes noted for the nursing young of rats on a diet deficient in the vitamin B complex were fatty metamorphosis of the liver, atrophy of the spleen, hemorrhages in the osteogenic tissues, and anhydremia associated with

disturbance in the hematopoietic function. In the nursing young of rats deprived of vitamin B_1 alone, the changes noted were reduction in the glycogen content of the liver and atrophy of the spleen, as well as hypoglycemia and anhydremia associated with hematopoietic disturbance.

In weaned rats deprived of the vitamin B complex the changes were simply those associated with inanition. Hypertrophy of the adrenal glands and of the heart was also noted and in some animals fatty metamorphosis of the liver. In the studies on the effect of vitamin B_1 on weaned rats, some of the animals were deprived entirely of the vitamin and others were given amounts inadequate for optimum growth. In both groups atrophy of the spleen and hypertrophy of the adrenal glands and heart (the latter mainly due to increased blood volume) were noted.

Data are also reported showing that differences in the food intake and growth of rats receiving supplements of the vitamin B_1 concentrate and the controls receiving no concentrate were not proportional. The controls in some cases had as high a food intake as those receiving the supplements of vitamin B_1.

A final section contains data on the total and differential blood count in rats deprived of vitamin B_1. As had previously been noted in a similar study of the vitamin B complex (E. S. R., 62, p. 297), no noteworthy change was found in the total leucocyte count. There was, however, a pronounced change in the polymorphonuclear-lymphocyte ratio, the lymphocytes being markedly reduced and the polymorphonuclear cells increased.

II. *Pathologic changes in the albino rat suffering from vitamin G deficiency*, H. S. Thatcher, B. Sure, and D. J. Walker.—In this study of the symptomatology of vitamin G (B_2) deficiency in rats, eight different vitamin G-deficient rations were used, with a total of 64 animals. Comparisons were made with 12 controls on a ration containing autoclaved yeast and an abundance of a vitamin B concentrate and with 20 normal rats on the stock diet.

Among the observations considered sufficiently characteristic to tabulate are dermatitis, ophthalmia, chromogenic urine, and incontinence of urine, together with weight changes.

Dermatitis was encountered in 42 per cent of the animals and ophthalmia in only 15 per cent. Chromogenic urine was observed in 25 per cent and incontinence of the urine in 14 per cent of the entire number. In 15 of the 27 cases of dermatitis, the onset of dermatitis preceded cessation of growth. Ophthalmia, when present, sometimes appeared before and sometimes after the dermatitis. In over 50 per cent of the animals cessation of growth was not accompanied by any skin lesions. "Such evidence does not justify the conclusion that the antidermatitic and growth-promoting syndromes associated with vitamin G deficiency are identical."

Among the pathological changes noted in addition to the skin lesions, which are described in detail, were atrophy of the spleen and of the thymus, fatty changes in the liver, and hemorrhages and congestion of the intestines. In comparing the lesions with those of human pellagra, a seasonal variation in the occurrence of the dermatitis but not the other symptoms is thought to be in harmony with human pellagra, but the skin lesions, while bilateral as in man, were not absolutely comparable with those of human pellagra. "In our opinion neither we nor other investigators preceding us have actually produced a disease in the rat comparable with human pellagra. All that can be said is that pellagra-like symptoms have been experimentally produced. If a true seasonal variation can be established, this might be of considerable importance."

The evaluation of vitamin D preparations, II [trans. title], M. SCHIEBLICH (*Biochem. Ztschr., 230 (1931), No. 4–6, pp. 312–319*).—Following the same general technic as in the previous study (E. S. R., 62, p. 298), the author has compared curative with prophylactic methods for determining the vitamin D content of several preparations, with the conclusion that the curative and protective dosages are in no case the same, the former always being higher and in some cases much higher than the latter. The line test in general gave results corresponding closely to the Röntgen ray test. In his opinion, keeping the rats on screens to avoid consumption of the feces is not necessary, nor is there any risk of the results being vitiated by traces of vitamin D such as might be left on the cages in washing. The use of separate cages is considered essential.

MISCELLANEOUS

Yearbook of Agriculture, 1931, A. M. HYDE ET AL. (*U. S. Dept. Agr. Yearbook 1931, pp. IV+1113, figs. 213*).—This contains the report of the Secretary of Agriculture, over 200 brief articles arranged alphabetically by subjects and discussing recent developments under the general title of What's New in Agriculture, a list classified by general subject matter of the Department publications of the calendar year 1930, an article entitled Crop and Livestock Production Trends noted on page 482, and the usual statistics noted on page 486.

Forty-first Annual Report [of Alabama Station, 1930], M. J. FUNCHESS ET AL. (*Alabama Sta. Rpt. 1930, pp. 38*).—This contains the organization list and a report on the work and publications of the station for the fiscal year ended June 30, 1930. The experimental work not previously reported is for the most part abstracted elsewhere in this issue.

[Annual Report of Florida Station, 1930], W. NEWELL ET AL. (*Florida Sta. Rpt. 1930, pp. 137+VIII, figs. 8*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1930, and departmental reports, the experimental features of which, not previously reported, are for the most part abstracted elsewhere in this issue.

***A year's service of research*: Annual report of the director, [Wisconsin Station, 1930],** compiled by N. CLARK (*Wisconsin Sta. Bul. 420 (1931), pp. 138, figs. 47*).—This contains the organization list, an account of the activities of the station, a list of the station publications of the year, and a financial statement as to the Federal funds for the year ended June 30, 1930. The experimental features not previously reported are for the most part abstracted elsewhere in this issue.

Michigan Agricultural Experiment Station Quarterly Bulletin, [February, 1931], edited by V. R. GARDNER and A. J. PATCH (*Michigan Sta. Quart. Bul., 13 (1931), No. 3, pp. 105–178, figs. 14*).—In addition to articles abstracted elsewhere in this issue or previously, this number contains the following: Fertilizers Aid Alfalfa Yields on Heavy Soils, by R. L. Cook (pp. 116–118); Need Quack Grass Control in Potato Fields, by A. Berridge (pp. 128–130); and Good Seed Potatoes Are Not Plentiful This Year, by H. C. Moore (pp. 145, 146).

The South Carolina Agricultural Experiment Station: A brief history, 1887–1930, G. H. AULL (*South Carolina Sta. Circ. 44 (1930), pp. 63, figs. 27*).—This circular is noted editorially on page 405.

NOTES

Tuskegee Institute.—At the recent commencement a bronze bas-relief was unveiled of Dr. George W. Carver, director of the station and consulting chemist and associated with the agricultural chemistry and other work of the institution for over 30 years.

California University and Station.—Myer Edward Jaffa, professor of nutrition emeritus, chief of the bureau of food and drugs of the California State Board of Health since 1925, and a consulting nutrition expert to that board since 1915, died June 29, aged 64 years. Prof. Jaffa was born in Sydney, Australia, but graduated from the University of California in 1877, and aside from brief periods as assistant chemist of the Tenth Census and the Northern Transcontinental Survey spent practically his entire career in the State. He was appointed assistant in the agricultural department in 1880, and subsequently served in the same capacity in the departments of viticulture and agricultural chemistry. He became assistant professor of nutrition in 1906 and head of this department in 1908. In addition to his extensive service along regulatory lines, he will be remembered as a pioneer worker in the food and nutrition of man in cooperation with the nutrition investigations of the U. S. D. A. Office of Experiment Stations. Among his contributions in this field were his dietary studies with the Chinese and other groups and his extensive work on the digestibility of fruit and nuts.

Connecticut College.—The fiftieth anniversary of the college was observed June 6 in connection with the installation of Dr. Charles Chester McCracken as president. Among the speakers was Dr. W. O. Thompson, president emeritus of Ohio State University.

Connecticut State Station.—A conference of Connecticut and Rhode Island investigators in the chemistry and physiology of plants was held June 5 and 6 in the laboratories of Yale University and the station.

Hawaiian Sugar Planters' Station.—Dr. Frederick A. G. Muir, entomologist from 1905 to 1928 and consulting entomologist thereafter, died in England May 13 at the age of 59 years. Dr. Muir was widely known as a pioneer worker in the field of biological control, traveling widely over the Orient in his search for the native countries and parasitic enemies of sugarcane pests. Among his introductions were the predacious capsid bug (*Cyrtorhinus mundulus*) from Fiji and Australia in 1919, the tachinid fly (*Ceromasia sphenophori*) from New Guinea, and the solitary wasp (*Scolia manilae*) from the Philippines in 1916. These insects proved very useful in the control, respectively, of the sugarcane leafhopper, the cane borer beetle, and the Anomala beetle. Dr. Muir was also a voluminous writer. The honorary degree of doctor of science was conferred upon him by the University of Hawaii in 1928.

Kansas College and Station.—S. C. Salmon, professor of agronomy and in charge of the farm crops work of the station, has resigned, becoming on July 1 principal agronomist in the Office of Cereal Crops and Diseases of the U. S. D. A. Bureau of Plant Industry.

Louisiana University and Stations.—The office of dean of the College of Agriculture and director of the station has been divided, Dr. C. T. Dowell continuing to serve as director, while J. G. Lee, jr., who has been head of the department of agricultural education, was made dean and director of extension. In the department of animal industry, Dr. Charles I. Bray is to devote

his entire time to the work of the station and Dr. M. G. Snell the greater portion of his time to station work. J. B. Francioni, jr., assistant professor, is to have charge of the teaching. The poultry work has also been rearranged, the entire time of Charles W. Upp being given to station work and that of Harry Smith to instruction.

Dr. Gertrude L. Sunderlin, research associate professor of home economics, has resigned, effective July 1. T. L. Smith has been appointed to take up research work in rural sociology on the same date.

Massachusetts Station.—Esther S. Davies, assistant research professor in home economics since 1927, died July 12. Miss Davies was a graduate of the College of Wooster and of Simmons College and had had a varied experience as secretary and research assistant in the department of social sciences, Yale University, from 1912 to 1915; assistant statistician, Russell Sage Foundation, 1915–16; assistant secretary and editor of the National Tax Association, 1916–1918; statistician, Office of the Chief Quartermaster, A. E. F., at Tours, France, 1918–19; overseas financial agent, National Board of the Y. W. C. A., with headquarters at Constantinople, 1919–20; statistician, Atlantic division, American Red Cross, 1920–1922; medical editor and registrar of schools, Battle Creek Sanitarium, 1922–1925; and statistician of the Bellevue-Yorkville Health Demonstration, 1925–1927. In the three and a half years of her service in Massachusetts she had developed an extensive and constructive research program pertaining to problems of nutrition as related to the juvenile population of the rural districts of the State. Her investigations had dealt with the food consumption of rural school children in relation to their health, a study of midday lunches in connection with the consolidated school system of the State, and a comparative study of the value of milk and tomatoes for supplementary school feeding.

Nebraska University and Station.—On the evening of May 15 the greater part of the interior of the animal husbandry building was destroyed by fire. Fortunately the second floor offices escaped injury, and the records, while damaged, were all saved. The building will be rebuilt as a fireproof structure.

A. D. Weber, associate professor of animal husbandry and assistant animal husbandman in charge of sheep investigations, resigned July 1 to accept a position in the Kansas College and Station and was succeeded by M. A. Alexander, assistant professor of animal industry and assistant animal husbandman in the Wyoming University and Station.

New Hampshire University.—Dr. R. C. Bradley has been appointed extension poultry specialist vice Walton P. Clarke, who died March 20.

Rutgers University and New Jersey Stations.—At the recent commencement of the university, the honorary degree of doctor of philanthropy was conferred upon James Neilson, an early advocate of the station and a member of the board of trustees since 1886. The honorary degree of master of science was conferred upon Maurice A. Blake, horticulturist since 1906 and professor of horticulture since 1913.

The dairy research station recently acquired (E. S. R., 65, p. 100) will be known as the James Turner Institute for Research. John W. Bartlett, dairy husbandman, and C. B. Bender, assistant in dairy husbandry, have been given general administrative charge of the institute, with Hubert H. Tucker as resident administrator. Among the projects to be taken up is one in breeding, in which some of the Holsteins and Guernseys which have been acquired will be used in an attempt by inbreeding, outcrossing, and selection to increase the fat content of Holstein milk without lowering milk production and to develop a rugged uniform type of Guernsey which will produce a large quantity of high test milk. Studies in nutrition will also be undertaken.

Cornell University and Station.—Dean and Director A. R. Mann has been appointed provost of the university beginning about September 1. In his new position he will be the executive officer of the university and ex officio a member of each of the university's special faculties. Dr. Cornelius Betten has been appointed acting dean and director of the New York State College of Agriculture, the Cornell Station, and the New York State College of Home Economics, beginning August 1.

Ohio State University.—The State appropriations for the biennium 1931–1932 have been reduced from $9,879,206 to $7,939,826. This reduction will entail a marked decrease in outlay for capital equipment and maintenance, and but $6,131,530 will be available for salaries and wages as compared with approximately $6,500,000 at the present time.

Ohio Station.—The honorary degree of doctor of science was conferred upon Director C. G. Williams by the College of Wooster at its recent commencement.

Pennsylvania College and Station.—Dean and Director R. L. Watts received the honorary degree of doctor of science from the Rhode Island State College at its recent commencement.

Rhode Island Station.—Dr. Robert Learmonth, assistant in animal breeding and pathology, resigned May 1 and was succeeded July 1 by Dr. John Paul Delaplane. J. George Fielding was appointed on July 1 assistant in agricultural economics.

Vermont University and Station.—The honorary degree of doctor of science has been conferred by the Massachusetts College upon Dean and Director J. L. Hills, an alumnus of that college in the class of 1881.

Virginia Polytechnic Institute.—Special exercises were held July 29 in commemoration of the centennial of the first demonstration of the newly invented reaper, held in Rockbridge County in 1831. In addition to addresses by former Gov. E. Lee Trinkle, Dr. George E. Vincent, Alexander Legge, Cyrus Hall McCormick, jr., and others, the program included a motion picture film entitled The Romance of the Reaper, an exhibition of models of farm equipment, and a pageant in six scenes portraying the historical development of grain harvesting methods and equipment.

The new dairy husbandry building was dedicated July 28. This is a three-story and basement structure constituting the first unit of an agricultural quadrangle. It contains offices and classrooms of the dairy husbandry, poultry husbandry, and agricultural education departments, extensive dairy manufacturing and other laboratories, and a complete refrigeration plant.

Washington Station.—Recent appointments include Donald Brazie as instructor in poultry husbandry vice L. W. Cassel, resigned beginning July 15, and Dr. L. C. Wheeting as associate in soils beginning July 1.

West Virginia University and Station.—A new water system has been installed on the station dairy farm with a pump capacity of 15 gal. per minute and a storage capacity of 3,000 gal. The new system also supplies water for the horticulture and poultry farm units nearby.

Horace Atwood, head of the department of poultry research and for 34 years a member of the station staff, has retired as professor emeritus of poultry husbandry. Beginning in 1897 as assistant agriculturist, he made numerous studies of crop production and livestock feeding and management and since 1913 has been engaged principally in research in poultry problems. He is the author of over 40 station bulletins and circulars, together with a considerable number of other scientific papers.

In the department of horticulture, M. B. Hoffman, instructor and assistant, has accepted a fellowship in plant science at Cornell University and will be

succeeded on September 15 by W. H. Childs. Ruth Braden has been appointed instructor in home economics vice Vivian Stone, resigned.

1931 Capper Award.—Dr. L. O. Howard, associated with the entomological work of the U. S. Department of Agriculture since 1878 and in charge of this field from 1894 to 1927, is the recipient of the second Capper Award for Distinguished Service in Agriculture. He retired from the Department on June 30 at the age of 74 years with the expectation of spending the immediate future in Paris in the preparation of additions to the approximately 1,100 contributions from his pen to the literature of science.

Sixth International Congress of Genetics.—This congress will meet at Cornell University from August 24 to 31, 1932. It will be preceded by the Eugenics Congress in New York City and by visits of foreign delegates to the Carnegie Station for Experimental Evolution at Cold Spring Harbor, N. Y., the New York Botanical Garden, the Boyce Thompson Institute, the Cornell Medical School, the Rockefeller Institute, the Medical Center of Columbia University, the American Museum of Natural History, and other points of interest. During the congress, it is expected there will be excursions to Niagara Falls and to the New York State Experiment Station at Geneva, at which latter point there will be exhibits dealing with fruit genetics and fruit breeding. Other trips may be arranged to follow the congress.

Commonwealth Fund Fellowships.—It is announced that six members of the staffs of various departments of the Government of the British Empire will enter universities in the United States in the fall of 1931 under two-year fellowships in the seventh annual award under this service fund. These service fellows come from New Zealand, Union of South Africa, India, and Palestine. Their subjects of study are irrigation, land drainage, flood control, hydroelectric power, soil bacteriology, poultry nutrition, Negro education, and the economic development of backward territories, and the institutions selected are the Universities of California, Wisconsin, and North Carolina and Columbia University.

New Journals.—*Horticultural Abstracts* is being issued quarterly by the Imperial Bureau of Fruit Production, East Malling, Kent, England. The initial number contains 110 abstracts classified under sections of general horticulture; viticulture, small fruits, and nuts; tree fruits; physiology, chemistry etc; citrus; tropical crops; storage and transport; and conferences. Each abstract is also given a card index classification number based on the Brussels International Decimal Classification.

Brittonia is being published at irregular intervals by the New York Botanical Garden. It is planned primarily to cover the fields of systematic botany and plant geography, although papers in other fields of botanical science are not excluded. The initial number contains a discussion of One Name Periodicals, by E. D. Merrill (pp. 1–5), and a paper entitled A Short Phytogeography of the Prairies and Great Plains of Central North America by P. A. Rydberg (pp. 57–66).

Journal of Science of the Hiroshima University is being published from time to time by the university at Hiroshima, Japan. The initial number consists of an article in German on Chromosome Count and Phylogeny in the Genus Potentilla, by N. Shimotomai (pp. 1–11).

EXPERIMENT STATION RECORD

VOL. 65 OCTOBER ABSTRACT NUMBER No. 6

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

Observations on the so-called vitamin A [trans. title], W. CORNELI (*Hoppe-Seyler's Ztschr. Physiol. Chem., 191 (1930), No. 1–2, pp. 86–88*).—The author has repeated the procedure of Shimizu and Hatakeyama for preparing desoxycholic acid compound of vitamin A from egg yolk (E. S. R., 62, p. 93), but reports a melting point after 5 or 6 recrystallizations of 181° C. instead of 187° and a molecular weight of 444.4 instead of 468 as reported previously. According to these values the compound should contain 8 instead of 5 molecules of desoxycholic acid.

The reaction of antimony trichloride with cod-liver oil and its unsaponifiable fraction E. L. SMITH and V. HAZLEY (*Biochem. Jour., 24 (1930), No. 6, pp. 1942–1951, figs. 3*).—Attention is called to the fact that Norris and Church (E. S. R., 63, p. 110) used petroleum ether and ethylene dichloride for extracting the unsaponifiable matter of fish liver oils in some of their studies of the antimony trichloride reaction for vitamin A and that these solvents are notoriously inefficient for the complete extraction of the unsaponifiable matter. Using ether, ethyl acetate, and chloroform, the authors have secured practically complete extraction of the unsaponifiable matter from cod-liver oil and with no appreciable loss of chromogen by oxidation or thermal destruction. This was indicated by the fact that when such extracts were submitted to the antimony trichloride test the dilution effect could be represented by a straight line tangential at the origin to the dilution curve for the corresponding oil. Directions are given for carrying out the antimony trichloride color test on the unsaponifiable fraction extracted with chloroform.

The effect of hydrogen ion concentration upon the precipitation of certain basic substances by phosphotungstic acid, R. A. PETERS (*Biochem. Jour., 24 (1930), No. 6, pp. 1852–1855, fig. 1*).—Data are reported on the H-ion concentrations at which phosphotungstic acid first causes precipitation with various basic substances. The method is essentially as follows:

Phosphotungstic acid (Mercks' puriss.) in 10 per cent concentration is carefully brought to pH 6 with 20 per cent sodium hydroxide. The substance to be tested, in a concentration of at least 1 mg. per cubic centimeter, is brought to pH 7 to 8, and from 1 to 2 drops (0.05 cc.) of the phosphotungstate is added. If there is no opalescence, N/100 to N/10 H_2SO_4 is cautiously added from a microburette until a faint opalescence appears. This indicates the beginning of precipitation and is the point at which the pH is determined colorimetrically.

The H-ion concentration at which the precipitate first appears differs markedly with different bases and appears to depend to a large extent upon the chemical constitution of the base. With most of the bases studied the precipitation occurred upon passing from a more alkaline to a less alkaline solution, but with guanidine compounds this was reversed.

The relation of hydrogen ion concentration to the precipitation of purified torulin (yeast vitamin B_1) by phosphotungstic acid, H. W. Kinnersley and R. A. Peters (*Biochem. Jour., 24 (1930), No. 6, pp. 1856–1863*).—The fact established in the investigation noted above that precipitation of certain bases with neutralized phosphotungstic acid takes place at a pH dependent upon the nature of the base was made use of in the fractional precipitation of vitamin B_1 concentrates at various pH values. In the experiments reported the starting material consisted of torulin from the decomposed phosphotungstate obtained from a charcoal concentrate fractionated first with alcohol and later with phosphotungstic acid at an acid pH. The method has not been found applicable to torulin before the charcoal adsorption stage, but can be applied immediately after this stage. The results are thought to be more certain, however, if the hydrogen sulfide treatment to remove metals is followed.

The process of fractional precipitation is described in detail in outline form. The starting material was a 50 per cent acid alcoholic extract of vitamin adsorbed upon norite charcoal. Five phosphotungstate precipitations were carried through with an increase in activity from 1 mg. approximately per day to 0.012 mg. "The final material is mainly crystalline and has a little more than half the activity of the rice vitamin crystals of the Dutch workers. The experiment lends additional support to the view that we are dealing with a basic substance."

The alcohol-solubility of the anti-dermatitis, more heat-stable vitamin B_2 constituent of the vitamin B complex, H. Chick and A. M. Copping (*Biochem. Jour., 24 (1930), No. 6, pp. 1744–1747*).—Conflicting reports on the alcohol solubility of vitamin B_2 are summarized, including the report of Chick and Roscoe (E. S. R., 61, p. 710) of the destruction of vitamin B_2 by alcohol at a concentration of from 83 to 93 per cent by weight, of Sherman and Sandels (E. S. R., 61, p. 592) indicating similar loss in potency on extraction with 6[illegible] to 80 per cent alcohol, but no loss with 95 per cent alcohol, and of Narayanan and Drummond (E. S. R., 63, p. 709) indicating that alcohol of 70 per cent concentration precipitates vitamin B_2 without much loss in activity. Unsuccessful attempts to repeat the work of Narayanan and Drummond are reported briefly.

It was found that precipitation with 56 per cent alcohol at pH 1.5 caused the disappearance of about one-half of the vitamin B_2 originally present in the extract used and subsequent treatment with 70 per cent alcohol the destruction or inactivation of the remainder, while with less acid material, pH 3.2, inactivation took place with 56 per cent alcohol. Similar results were obtained with a vitamin B_2 preparation from egg white. It is suggested that the discrepancy between these results and those of Narayanan and Drummond may have been due to differences in the reaction of the solutions employed. Attention is called to other discrepancies reported in the literature concerning the properties of vitamin B_2.

In the opinion of the authors, vitamin B_2 "is probably not a well-defined stable chemical entity. Its solubility and precipitation limits are irregular and uncertain and are greatly influenced by small variations in the conditions under which they are studied. These conditions include the dilution and H-ion concentration of the solution and the presence and concentration of salts and of

substances. There must also be other disturbing substances which are at present unrecognized. In this laboratory it has often proved impossible to repeat a given observation under apparently similar conditions. Much more investigation is needed to eliminate these difficulties and, in the meantime, the necessity for including exact details of procedure in all published work is obvious. A further complication arises from the fact that the usual method for estimation of vitamin B_2 consists in a growth test with young rats and, therefore, is very liable to erroneous interpretation unless strictly controlled. A more satisfactory criterion would be the cure of the dermatitis which occurs in rats on diets deprived of this vitamin, but the skin lesions are irregular and slow of development (8–30 weeks) so that such tests are impracticable on a large scale."

The antiscorbutic fraction of lemon juice, IX, S. S. Zilva (*Biochem. Jour.*, *24* (*1930*), *No. 6, pp. 1687–1698, figs. 2*).—This continuation of the series of papers noted previously (E. S. R., 62, p. 803) deals chiefly with the details of the author's method of fractionation of lemon juice for the purpose of concentrating and determining the chemical nature of vitamin C and the mechanism controlling its spontaneous inactivation, with the special purpose of emphasizing caution in the interpretation of the available evidence on the chemical behavior of the vitamin.

A detailed description is first given of the method of preparing the antiscorbutic fractions, and the results are summarized of guinea pig tests on 11 series of such concentrates prepared during the years 1925 to 1930. These show that under presumably the same conditions of fractionation wide variations occur in the activity of the concentrates. One of the factors found to be responsible for such variations is the amount of neutral lead acetate used as the precipitating agent. With a uniform supply of lemons the same amount of this precipitating agent can be used during the two months' duration of the test, but a new batch may require a different amount for optimum results. In general, amounts of the reagent varying from 18 to 25 per cent of the volume of the juice are required, but sometimes good results may be obtained with equal volumes of the lead acetate and the juice. The nature of the factor in lemon juice controlling the precipitation of vitamin C by lead acetate has not been determined, but the reducing capacity for phenolindophenol of the final fraction may be utilized as an index for determining the optimum amount of the lead acetate to add.

Attempts at further purification of the active factor by reprecipitation, as practiced by Grettie and King (E. S. R., 62, p. 501) and Sipple and King (E. S. R., 62, p. 804), were unsuccessful, nor was it possible to repeat Bezssonoff's results with cabbage juice (E. S. R., 53, p. 608).

In order to test further the hypothesis that "the accelerated inactivation of the antiscorbutic factor in neutral solution produced by the previous autoclaving of the decitrated lemon juice is due to a chain of reactions in which the thermostable peroxidase and a substance formed during the heating are concerned," the effects were studied of the addition of quinhydrone, benzoquinone, or an ethereal extract from autoclaved lemon juice decolorizing iodine but not phenolindophenol. All of these accelerated to a marked degree the destruction of both the reducing principle and the antiscorbutic factor in a neutral medium in the presence of air. This is explained as follows: "It is possible that a substance of phenolic character, oxidizable in the air, is formed in the process of autoclaving. This compound in its oxidized form destroys, in conjunction with the peroxidase present in the juice, the reducing principle that acts as an agent for the protection of the antiscorbutic factor."

In a final series of tests the effect of hydrochloric acid on the stability of vitamin C in lemon juice stored for a short period of time was tested, in

view of the observation of Williams and Corran (E. S. R., 63, p. 609) that lemon juice to which hydrochloric acid had been added to lower the pH to less than 1.8 lost much of its antiscorbutic properties in a few months. Decitrated lemon juice adjusted to approximately pH 1 by 4 N HCl and stored in the cold for 7 days under aerobic conditions lost almost none of its antiscorbutic properties. Although the reducing capacity of the juice was somewhat decreased, the loss was no greater than when the juice was stored at pH 7.

The density of water adsorbed on silica gel, D. T. Ewing and C. H. Spurway (*Jour. Amer. Chem. Soc., 52 (1930), No. 12, pp. 4635–4641, figs. 3*).—The density of water films adsorbed on silica gel surfaces was determined in the experiments here reported from the Michigan State College by means of volume measurements made with a gas dilatometer in which helium was used as the inert gas. It was shown that for quantities of water up to 4.36 per cent, "the density of water adsorbed on silica gel at 25.02° [C.] is greater than the density of liquid water at the same temperature."

Effect of copper and lead ions upon the rate of decomposition of hydrogen peroxide at various acidities, H. W. Rudel and M. M. Haring (*Indus. and Engin. Chem., 22 (1930), No. 11, pp. 1234–1237, figs. 3*).—The rate of decomposition of 30 per cent hydrogren peroxide at varying acidities in the presence of varying concentrations of copper and lead ions was investigated at the University of Maryland.

"The rate of decomposition increases with increasing pH. Copper ion has a marked catalytic effect on the decomposition, even in traces, while lead ion has a slight inhibitory effect. Explanations for the various curves are offered."

***Determination of magnesium with 8-hydroxyquinoline—gravimetrically,* volumetrically, and colorimetrically,** W. A. Hough and J. B. Ficklen (*Jour. Amer. Chem. Soc., 52 (1930), No. 12, pp. 4752–4755, fig. 1*).—The three procedures here given in working detail were found to save time and to possess an accuracy quite adequate for many cases. It was found that of the metals other than magnesium commonly found in natural waters only calcium would react with 8-hydroxyquinoline.

"The most advantageous method to use depends on the amount of magnesium in the sample. (*a*) For amounts ranging from 0.0010 gm. up to the highest concentrations, the gravimetric method is most accurate. (*b*) For amounts ranging from a minute trace up to 0.0025 gm. the volumetric method is most accurate, and is very quick in comparison with many methods commonly used. (*c*) For amounts ranging from 0.0005 gm. up to high concentrations (if proper aliquots are taken), the colorimetric method is very accurate and is the quickest of the three methods."

Determination of soil organic matter, C. J. Schollenberger (*Soil Sci., 31 (1931), No. 6, pp. 483–486*).—It is recommended by the author of this contribution from the Ohio Experiment Station that the procedure originally proposed by him for the determination of soil organic matter (E. S. R., 58, p. 113) be modified so that it shall be prescribed that one "proceed as originally directed, or according to the modification suggested in the last paragraph, or one of the procedures described by Degtjareff [E. S. R., 63, p. 505], up to the point at which the solution is transferred to a beaker for titration. Dilute with recently boiled and cooled water to at least 10 but not more than 15 times the volume of concentrated sulfuric acid present and cool. To this solution add, in volume equal to half that of concentrated sulfuric acid in the solution, either 85 per cent phosphoric acid or 48 per cent hydrofluoric acid or the approximate equivalent of the latter in powdered sodium fluoride, i. e., 5 gm. NaF for 10 cc. con- [illegible]

solution and titrate with standard ferrous ammonium sulfate solution to total disappearance of blue from the green solution. Deduct the burette reading from that of a blank titration conducted under precisely similar conditions except that no sample is used, and from the number of cubic centimeters of iron solution equivalent to organic matter in the sample calculate the amount present. One cubic centimeter 0.2 N ferrous ammonium sulfate solution is equivalent to approximately 0.25 per cent organic matter in a 0.5-gm. sample, or 2.5 tons in an acre."

The presence of uronic acids in soils, E. C. Shorey and J. B. Martin (*Jour. Amer. Chem. Soc., 52 (1930), No. 12, pp. 4907-4915*).—This paper presents the results of the soil fertility laboratory, U. S. D. A. Bureau of Chemistry and Soils in the "examination of 11 samples of soil for the presence of uronic acid, according to methods adopted and in use for the determination of these acids in vegetable products. The soils are from 8 locations and represent types varying from sandy loams containing 0.82, 0.88, and 0.96 per cent of organic carbon to loams containing 3 and 4.9 per cent of organic carbon, a muck containing 30 per cent and a peat containing 53 per cent organic carbon. These soils varied in reaction from pH 4.7 to 8.3. The uronic acid carbon dioxide varied from 0.07 to 1.8 per cent of the soil, and this, when calculated to the equivalent uronic acid, varied from 0.308 to 7.94 per cent of the soil. The uronic acid carbon calculated from these figures varied from 0.113 to 2.86 per cent of the soil, and this uronic acid carbon varied from 5.15 to 28.4 per cent of the total organic carbon. The presence of uronic acids or complex substances containing them (polyuronides) was confirmed by the separation from two of the soils of colloidal material having all the properties of such uronic acid complexes. This separation was made both by hot water extraction and extraction with dilute sodium hydroxide."

The bearing of the presence of uronic acids in soils on certain analytical operations, as the determination of carbonates in soils and methods proposed for the proximate analysis of the organic matter of soils, is pointed out.

A new method of estimating total carbonates in soils, A. N. Puri (*Imp. Inst. Agr. Research, Pusa, Bul. 206 (1930), pp. [1]+7*).—With respect to the standard methods for the determination of total carbonates in soils the author remarks that "these methods are capable of giving accurate results, but are time-consuming and the number of soils that can be examined at a time is limited by the number of absorption outfits that one can conveniently attend to or the space available," and that these methods are further subject to a variety of errors and require special precautions for reliable and reproducible results. He then presents the following directions for a procedure designed to obviate some of these difficulties.

Stir 10 gm. of the soil with 100 cc. of water in a conical flask, add an excess (from 0.2 to 0.5 gm.) of calcium sulfate, and bring the mixture to the boiling point. Add 10 cc. of 0.1 N aluminum chloride solution, and shake the suspension, then add about 10 drops of a 1 per cent alcoholic solution of bromothymol blue and let the suspension settle after a vigorous shaking.

"Yellow color [in the clear supernatant solution] indicates less than 1 per cent, green to blue color above 1 per cent carbonates. Ten drops of brom cresol green (1 per cent alcoholic solution) are then added and the color again noted. Golden yellow color indicates absence of carbonates, green color indicates carbonates less than 1 per cent, deep bluish green color indicates carbonates above 1 per cent.

"If carbonates are present the procedure is as follows:

"The flask is brought to the boiling point and the contents titrated against N/2 H_2SO_4. The suspension is boiled for a minute or two after each addition

and allowed to settle for a couple of minutes. This, however, is only necessary in the later stages of titration, as it is easy to see the green colored edge in the beginning. The titration is complete when the color of the supernatant liquid is golden yellow which persists on boiling the suspension for a couple of minutes and allowing it to settle for a minute or two; and the amount of H_2SO_4 used up is equivalent to the total carbonates in the soil. As a rule about 8–12 titrations are started all at once and completed in about a couple of hours. The idea of noting down the color immediately after the addition of the indicator is to be able to judge the approximate amount of N/2 H_2SO_4 that should be added each time during the course of the titration. For instance, 4 to 5 cc. for bluish green, 2 cc. for green, 1 cc. for yellowish green, and 0.5 cc. for greenish yellow color, could be added each time without the risk of overstepping."

A simple method of estimating total exchangeable bases in soils, A. N. Puri (*Soil Sci., 31 (1931), No. 4, pp. 275–279*).—The method described consists in the determination of carbonates by means of the author's titration method, noted on page 505, and the total bases by extraction with dilute hydrochloric acid, the difference between the two values thus obtained being considered to represent the total exchangeable base content. Determinations of the total exchangeable base figure as thus described are recorded for 49 soils from various parts of India.

How reliable are existing chemical methods for determining soil deficiencies in ash constituents of plants? G. S. Fraps (*Jour. Amer. Soc. Agron., 23 (1931), No. 5, pp. 337–351*).—Comparing the various generally accepted chemical methods, the Neubauer seedling method (E. S. R., 53, p. 319) and others, the author of this contribution from the Texas Experiment Station reaches the opinion that "the capacity of a soil to supply plant food is only one of a group of factors which determines how much plant food can be taken up by the crop, or what use can be made of it. The other factors include depth of the soil, its physical character, the kind of crop grown, climatic conditions, and others. There are close relations between the plant food removed in pot experiments and the chemical analysis of the soil for total nitrogen and for phosphoric acid and potash soluble in 1 per cent citric acid or 0.2 N nitric acid, as well as for other weak solvents.

"The chemical analysis offers a fairly accurate method of comparing the potential fertility of various types of soils, or the relative abundance or deficiency of nitrogen, phosphoric acid, or potash in a particular soil. In applying the chemical analyses to field work, the analyses can be grouped according to the quantities of plant food present, and the interpretation made according to the kind of crop to be grown, the characteristics of the soil type, and climatic or other factors which may affect the power of the plant to use the plant food. Chemical analyses in connection with field experiments are needed in order to set up standards of interpretation applicable to different soils, crops, and climatic conditions in various parts of the United States."

Chemical methods for estimating the availability of soil phosphate, P. L. Hibbard (*Soil Sci., 31 (1931), No. 6, pp. 437–466, figs. 2*).—The author of this contribution from the University of California points out the following as important among the sources of difficulty in attempting to estimate satisfactorily by chemical means the availability of soil phosphates: "Phosphate found in soils is mostly present in relatively slightly soluble combinations, so that the concentration in the soil solution is never high. Plants have selective action in absorption of nutrients, and also it seems probable that plants are able to take up ions such as PO_4, K, perhaps others from films of solution not represented by solutions prepared in the laboratory. No chemical agent can

imitate these effects of plants on soils. Many soils have such high fixing power that an easily soluble phosphate added to them is quickly fixed, thus becoming more or less unavailable to plants. Deficiency of other necessary plant nutrients in the presence of sufficient phosphate, or presence of excessive amounts of soluble salts or toxic substances in the soil, may cause the failure of plants. Test of a soil some time after phosphate has been added and after plants have grown on it subsequent to addition of the phosphate can not show the condition of the soil with which the plant had to deal at the start."

The following among other conclusions resulted from an experimental study of the conditions thus indicated: "Equilibrium, 1:5 extracts of soils with dilute acids provide the simplest and quickest means of obtaining some idea of the available phosphate, although such extracts do not always give a correct idea of the relative power of different soils to supply phosphate to plants. Extracts made with three or more different concentrations of an acid give a much better picture of the available PO_4 than is obtained by any single extract. Extracts thus made show only the PO_4 available at the time of extraction, not the relative supplying power of the soil for any great length of time. Citric and oxalic acids, because they form soluble complexes with Fe, Al, Ca, and Mg (the cations which tend to repress solubility of PO_4), are not appropriate for determining the availability of soil phosphates. A solution of CO_2 in water would be very appropriate for the purpose if it were easily possible to duplicate conditions at will, but its application is too difficult. Dilute K_2CO_3 hydrolyzes some phosphates and thus brings PO_4 into solution, but the results do not seem to have much bearing on availability.

"If results of tests of different soils are to be compared, the buffer power of the soil must be reckoned with. The amount of acid used in making an extract should be varied according to the buffer power of the soil so that the extracts of all soils will have the same pH, e. g. 4. This means that some soils will need two or three times as much acid as others to have an extract with pH 4. Since it is difficult to prepare a soil extract of exactly pH 4 or other definite figure, the PO_4 dissolved at any such definite point may be found exactly, by making three extracts with three different concentrations of acid, plotting the results, and from the graph finding the PO_4 at the desired pH. For this purpose, a highly buffered acid is desirable. Acetic is very appropriate, much better than HCl.

"The amount of PO_4 dissolved increases as the volume of solvent is increased, up to a large dilution. Water extracts of some soils have almost the same concentrations of PO_4 regardless of the volume of water used, up to a dilution of 100 or more water to 1 soil. The results of such equilibrium extractions seem to be more in accord with plants' response the nearer the proportion of water to soil is to that in the actual soil. But since such extracts are difficult to prepare, a ratio of 1 soil to 5 water serves very well and is more convenient. Vanstone's 'rate of solubility curve' does not in all cases express the plant availability of soil phosphate. It seems to offer little advantage over other equilibrium methods. Percolation methods of making soil extracts resemble the action of a plant more than equilibrium methods, yet do not show the power of the soil to continue supplying PO_4 so well as was expected and hoped. In these methods the soil is percolated slowly with very dilute acid till most of its soluble PO_4 is removed. An automatic apparatus for percolation has given very good results. Curves formed by plotting the results from percolation extracts are characteristic of the soil's individual power to supply phosphate. Percolation with 0.05 N HCl is supposed to dissolve from a soil all the PO_4 that may be expected to be available to plants for many years. Car-

bonic acid, 0.05 N, has much the same solvent power as HCl, but is very inconvenient. *Water alone or containing only a little CO_2 is so poor a solvent for soil PO_4 that it seems inadequate as an agent for estimating availability by percolation methods.*"

Successive water extracts made by diffusion through collodion bags were found to give an indication of the continuous supplying power of the soil much more satisfactory than that furnished by a single equilibrium extract, "but do not with certainty give proper relative values to all soils." A reference list of 31 titles covers the considerable number of published methods experimentally examined.

The cupro-potassium carbonate solution in the determination of reducing sugars, H. A. SCHUETTE and J. N. TERRILL (*Jour. Amer. Chem. Soc., 52 (1930), No. 12, pp. 4960–4964, fig. 1*).—The present paper continues a previous contribution (E. S. R., 64, p. 510), with results thus summarized:

"In a re-investigation of the so-called cupro-potassium carbonate solution *of Soldaini as modified in turn by Ost and by Nyns, there have been obtained data on the dextrose equivalents of four forms of this reagent of a copper* content lying between the limits of 19.1 and 39.3 mg. per cubic centimeter. These data are presented in the form of mathematical expressions and are pertinent to a temperature of 48.9° maintained for 2.5 hours. It was also found that this sugar, under the aforesaid conditions, has a reducing action upon that modification by Beyersdorfer which contains but 0.8 mg. of copper per cubic centimeter. This observation casts some doubt upon the acceptance of this solution as a selective reagent for levulose when both are present in the same solution.

"Mathematical expressions also have been derived for calculating the levulose-copper equivalents of another reagent of this type (copper content 4.03 mg. per cubic centimeter) when either one of three modes of reduction is used, the relevant variants being time and temperature so adjusted as to bear to each other a relationship which is approximately an inverse one. It has been pointed out that there exist no very material differences in the levulose equivalents of a given weight of cuprous oxide when the latter is precipitated by either one of these procedures."

A simple chemical test for predetermining the culinary quality of potatoes as affected by the accumulation of soluble sugars, W. M. PEACOCK and B. C. BRUNSTETTER (*U. S. Dept. Agr. Circ. 158 (1931), pp. 4, pl. 1*).—Since a high percentage of reducing sugars in potatoes has been found to be responsible for poor quality in potato chips and French fried potatoes, as well as giving an undesirable sweet taste to the potatoes when boiled, the determination of soluble sugars was selected as a logical means of judging the culinary properties of potatoes. *A trial of several methods led to the selection of the picric acid method as most satisfactory.*

Directions are given for preparing the potato sample and conducting the test. A color plate is given reproducing the colors obtained with samples of Green Mountain potatoes stored for 4 months at 32°, 36°, 40°, 50°, and 60° F., respectively. The colors grade from a garnet brown with the sample stored at 32° to a clear primuline yellow, indicating almost complete absence of reducing sugar, in the sample stored at 60°.

It is suggested that the test is applicable not only to the selection of potatoes for chip making, but also to the more accurate determination of the storage time and temperatures most favorable to the proper conditioning of potatoes for making chips. The test is also recommended to "buyers for hotels and restaurants where high-grade cooked potatoes, free from a sweetish taste, are desired."

Large-scale experiments in sulfuring apricots, E. M. Chace, C. G. Church, and D. G. Sorber (*Indus. and Engin. Chem., 22 (1930), No. 12, pp. 1317–1320, figs. 4*).—This investigation of the U. S. D. A. Bureau of Chemistry and Soils indicated "that the appearance of dried fruit is correlated with the sulfur dioxide content, and that the concentration of gas and length of sulfuring period are important factors, good fruit resulting after 2 hours in 3 per cent of gas. Temperature was a minor factor, although the best results were obtained at 100–110° F."

METEOROLOGY

The Weather Bureau, compiled by E. B. Calvert (*U. S. Dept. Agr., Misc. Pub. 114 (1931), pp. IV+34, figs. 11*).—This is a brief account of the history, organization, and work of the Weather Bureau, explaining how meteorological observations are recorded and made available for public use.

Bibliography of Commander Matthew Fontaine Maury, including a biographical sketch, R. M. Brown (*Va. Polytech. Inst. Bul., 24 (1930), No. 2, pp. 61, pl. 1*).—This bibliography and biography is noted here chiefly because of its references to Maury's early efforts (1851) to bring about the organization of "a uniform system of meteorological observations for the land as well as for the sea. . . . During 1855 he delivered many addresses on the subject to agricultural societies in the South and West. He asked farmers to cooperate in sending in systematic reports as to the temperature, the direction of the winds, and the condition and yield of crops. He also presented a memorial to Congress requesting that body to appropriate necessary funds for the establishment of a permanent office where these reports could be compiled, digested, and the results telegraphed at regular intervals to all parts of the country." Unsuccessful in these efforts at the time, "in October, 1871, Maury resumed his campaign, interrupted by the Civil War, for the establishing of a telegraphic meteorological bureau by Congress, a bureau that should regularly issue weather and crop reports," and continued to urge this undertaking until his last illness in 1872.

The success of the tests of the long-range predictions of British rainfall, D. Alter (*Quart. Jour. Roy. Met. Soc. [London], 57 (1931), No. 239, pp. 198–201, figs. 2*).—Continuing studies previously noted (E. S. R., 57, p. 207), observed rainfall was compared with rainfall predicted on periodogram analysis of British rainfall for 91 years. The author concludes that the results indicate the existence of periodicities in British rainfall which furnish a basis for predictions of agricultural and other economic value 10 years in advance.

Temperatures of peat soil relative to summer frost control, H. B. Roe, J. H. Neal, and B. R. and B. C. Colby (*Agr. Engin., 12 (1931), Nos. 3, pp. 93–98, figs. 8; 4, pp. 131–137, fig. 1*).—In studies conducted at the Minnesota Experiment Station, the results showed that barometric pressure indicates an opposite trend to air and surface temperatures from 60 to 65 per cent of the time in the peat soils under study. The trends of humidity show some tendency to follow temperature trends. Rain or a rainy period tends to raise the humidity sharply but only for very short periods. Cloudiness markedly restrains extremes of temperature. Frost is apt to occur on the second morning following a rain or rainy period, and a clear sky and northerly winds tend to predominate when the barometer is rising. A clearing sky in the evening is apt to be followed by a sharp drop in temperature early the next morning, and a northerly or more especially a northwest wind in the afternoon is likely to be followed by a dangerously low temperature early the following morning.

The phenomena or combinations thereof which are fairly reliable indications of approaching frost are enumerated as rising barometer, low or dropping

humidity, a clearing sky, and a northerly or northwest wind. Thoroughness of subdrainage of the peat soil increases the tendency to and the intensity of frost at the surface. Dryness of the peat surface increases the danger of frost.

A bibliography of 24 references to work bearing on the subject is included.

Extremes of temperature in Wisconsin, E. R. MILLER (*Wis. Acad. Sci., Arts, and Letters, Trans., 26 (1931), pp. 61–68, figs. 3*).—Extremes of temperature and their distribution in the State are shown, and the conditions under which they were recorded are described. The lowest temperature recorded, —54° F., occurred at Danbury, January 24, 1922, at a time when the region "was buried under a heavy snow cover." The highest temperature, 111°, was recorded at Brodhead, July 4, 1901. A moderating influence of the Great Lakes on both maximum and minimum temperatures is noted. "Latitude also appears important in the distribution of minima."

Discussing the conditions under which the observations were made, the author states that "all of the earlier observers, and most of the present-day cooperative observers, differ from the regular Weather Bureau stations in that their thermometers are exposed only a few feet above the ground, while the Weather Bureau offices, necessarily located in the business section of cities, have their thermometers exposed on buildings, which are steam-heated. The effect of this difference is easily seen in the records of extreme temperatures, especially in the minima."

The effect of rainfall and temperature on corn yields in Kansas, J. A. HODGES (*Jour. Farm Econ., 13 (1931), No. 2, pp. 305–318, figs. 4*).—The relation of rainfall and temperature to corn yields in the State as a whole and in selected type-of-farming areas was studied by application of multiple and multiple curvilinear correlation methods to data for the period 1892–1928.

The results show that "rainfall and temperature may have quite different effects in different type-of-farming areas. As type-of-farming areas are based partly on weather factors, this tends to show the justification and need of such a classification. If similar relations are worked out for other crops it will also help to show the comparative advantage of the particular crops for a type-of-farming area. It is further believed that the relationship between other important factors and yields might be worked out, which would help to determine type-of-farming areas more accurately." It is stated that "while the results presented in the present article do not show as close relationships in all cases as might be desirable for forecasting purposes, it is believed that they might be of material assistance in making estimates."

Meteorological observations, [March–June, 1931], C. I. GUNNESS and K. M. WHEELER (*Massachusetts Sta. Met. Ser. Buls. 507–510 (1931), pp. 4 each*).—Summaries of observations at Amherst, Mass., during March to June, 1931, inclusive, are given, with normals and extremes for these months during previous years.

Weather (*Rhode Island Sta. Rpt. [1930], pp. 46–48*).—A table is given which shows average temperature and average total rainfall by 5-day periods from January 1, 1890, to December 31, 1929, computed from observations at Kingston, R. I. The record for 1930 shows that a frost which injured tomatoes and potatoes occurred May 31, and one which injured soybeans, peppers, dahlias, and beets occurred October 19. "The greatest departure from normal climatic conditions was noted with rainfall. . . . Late crops . . . suffered appreciably due to the low moisture conditions. Second cuttings of alfalfa and hay were reduced in yield from normal as much as 50 per cent. Fall turnips were a com-

plete failure, and late cabbage produced about one-third of a normal crop. . . . The yield of carrots was reduced from 20 to 25 per cent by the dry soil conditions."

SOILS—FERTILIZERS

[Soil investigations of the Rhode Island Station] (*Rhode Island Sta. Rpt. [1930], pp. 31–33, 35, 38–40, 43, 44*).—This continues earlier work (E. S. R., 63, p. 616).

Organic matter for the soil.—In this comparison of sources of organic matter for the soil, it was found that "the green manure-chemicals plat yielded about 25 per cent more of No. 1 tomatoes than the stable-manure plat. The crop also was considerably earlier on the green-manure plat. In the 3-year rotation where the first crops are beets, spinach, and peppers, the beets yielded as well with 16 tons of manure where a green manure had been plowed in once during the round of the rotation as with 32 tons of manure compost, the fertilizer being the same. Spinach and peppers did not yield as well with the 16 tons as with the 32 tons. Reducing the nitrogen to one-half of the standard reduced the yield of spinach but not the yield of either beets or peppers. Reducing the phosphorus lowered the yield of peppers but not of beets or spinach. The yield of late carrots in this rotation was reduced where the nitrogen was decreased by 50 per cent. In another 3-year rotation the plats where 8 tons of manure compost and green manure were applied outyielded plats receiving 20 tons of manure compost without green manure." Early cabbage yielded as well with 1,500 lbs. of 8–6–6 as with either 8 tons of manure or with a green manure crop plus chemicals. Using only one-half the nitrogen decreased yields very decidedly, whereas phosphorus reduction had no effect. For celery, stable manure gave better results than did green manure, even when the latter was supplemented with commercial fertilizer. A single application of fertilizer at the time of setting celery gave as good results as did split applications.

Efficiency of fertilizers and manures.—In a rotation in which clover and grass seeded with the rye followed for 2 years a year in potatoes, "better stands of clover were obtained on the no- and medium-nitrogen plats than on the plat receiving the high nitrogen. The rye crop on the other plats responded with higher yields when the phosphorus was increased but not to increased potash. In another set of plats the yield of rye was reduced from 19.2 bu. per acre to 14.7 bu. when the amount of a 2–8–8 fertilizer was reduced from 500 to 316 lbs. per acre. The yield was increased to 23.9 bu. when the amount of fertilizer was increased to 667 lbs. per acre."

Modification of sour soil.—The work reported consisted in comparing the effect at two different acidity levels of ammonium sulfate with that of sodium nitrate on certain ornamental shrubs, the ammonium sulfate plats in each of the two acidity levels being held to a pH approximately the same as that of the sodium nitrate plats by the use of additional lime. It is noted that "several species continue to show a marked response to liming."

Soil nitrate nitrogen and vegetable crops.—The growing season of beets having been divided into three equal periods, the three soil nitrate levels, 10, 25, and 50 parts per million, were compared in 17 combinations. "The beets were grown in cylinders and the desired levels maintained by biweekly analysis of the soil and replacement of nitrate losses by applications of nitrate of soda in solution. The best yield of salable roots resulted from a level of 50 parts per million of nitrate nitrogen during the first two periods and 10 parts per million for the last period. Reduction of the level for the middle period of 25 parts per million approximated the normal course of nitrate re-

moval from a single application of nitrogen at planting time and produced a very satisfactory yield. Low yields resulted when nitrates were low during the first period. Spinach, treated similarly except that the growth was divided into but two periods, gave the best yields when the high level (50 parts per million) was maintained continuously for both periods." It was further determined that "for fall spinach an average of 60 parts per million throughout the growth period produced a yield of 2,547.5 bu., while 27 parts per million gave but 1,980 bu."

Nitrates in plant juices.—In sand cultures in the greenhouse "after the plants were 3 in. high, three comparative treatments in duplicate were maintained between the limits of 0–150, 150–300, and above 300 parts per million of nitrate nitrogen until the high nitrogen crops were well grown. Nitrate of soda applications were made in solution on the basis of both plant and sand analysis at frequent intervals. With increasing day length and rapid metabolism in the large leaves of the maturing crop in the spring, the 300 parts per million concentration could not be maintained. The yields of roots for the levels mentioned above were 2.5 lbs., 16.4 lbs., and 19.1 lbs., respectively." In a field plat experiment in which soil nitrate levels of 10, 25, and 50 parts per million were maintained, while "nitrate, ammonia, amide, and alpha-amino nitrogen fractions were determined each week in the juice expressed from the midrib-free portions of leaves," it is recorded that "the nitrate fraction has correlated closely with the nitrates in the soil, but the differences for the three treatments were not great. Fluctuations in nitrates caused by changing rates of metabolism were very wide despite the control of soil levels. The concentrations varied from traces to 300 parts per million of nitrate nitrogen, but were usually less than 150 parts per million."

Acid-base balance of plant ash.—"A simple method for determining the acid-base balance of the nonsilicious portion of plant ash, including the sulfur and chlorine often lost in ashing, was devised, and 90 samples representing a number of different crop species were analyzed. All samples showed an excess of alkaline elements. Season and fertilization affect the balance for individual plant species, but crops from a moderately fertile soil (pH 5.5) suggest the following grouping: Low alkalinity, corn, oats, rye, timothy, redtop, potatoes; medium alkalinity, millet, alsike, red clover, cabbage, rutabagas; high alkalinity, buckwheat, mangels. There was a tendency, not without notable exceptions, for increased alkalinity from increased nitrogen fertilization. Increased superphosphate decreased the alkalinity of the ash from rape grown at two levels of pH (5.2 and 6.5), but did not affect the ash of oats grown on the same soils. There was no significant correlation with pH for either crop."

Phosphate absorption by soils.—The results reported for the previous year (E. S. R., 63, p. 617) have been confirmed by further work, and "a high rate of liming, sufficient to change the acidity from pH 5.6 to 7.5 within the same period, has reduced the power of absorption. Phosphate was absorbed from the buffer solutions when adjusted to pH 5, 6, and 7, but was given up by the soil at pH values of 2 and greater than 10."

Indicator crops.—Macomber turnips proved very sensitive to lack of phosphorus, while buckwheat best indicated nitrogen deficiency.

Soil forming processes in the Hawaiian Islands from the chemical and mineralogical points of view, H. S. Palmer (*Soil Sci., 31 (1931), No. 4, pp. 253–265*).—The parent rock and corresponding more or less weathered material are compared in tabulations of the oxides as calculated from analyses, and of the mineral compounds thought likely to be the actual components of the material examined.

The conception of flow-plasticity as applied to soils, G. W. S. Blair (*Soil Sci., 31 (1931), No. 4, pp. 291–298, figs. 2*).—This contribution from Cornell University presents a brief description of the measurement of flow plasticity and "the relationship between flow data in general and plasticity in the sense defined by Wilson.[1] . . . It is claimed that flow plasticity should give an interesting test for studying changes taking place in the physical properties of soils; and three cases, where changes are caused by (1) addition of chalk and lime, (2) the normal leaching process, and (3) addition of sand to a heavy soil, have been investigated and are quoted." It was shown also that the plasticity of the soil is lessened by addition of lime and chalk.

The laws of soil colloidal behavior.—V, Ion adsorption and exchange, S. Mattson (*Soil Sci., 31 (1931), No. 4, pp. 311–331*).—Continuing this series of contributions from the New Jersey Experiment Stations (E. S. R., 64, p. 418), this paper takes up base exchange and the adsorption of anions.

The cationic exchange capacity of isoelectrically precipitated silicates, phosphates, and humates of aluminum and of iron of varying composition ratios was compared with that of natural soil colloids of a variety of silica-sesquioxide ratios. The exchange capacities at pH 7 were found to increase with the proportion of silica, phosphoric anhydride, and humus to sesquioxides in all the materials examined, the ferric complexes showing an exchange capacity for cations greater than that of the corresponding aluminum combinations. "The differences are explained on the assumption that the acidoid and ampholytoid constituents exist in partial combination with one another, resulting in compounds which are at the same time both acidic and basic. The free acidoid valences, uncombined with the ampholytoid valences, constitute the seat of cation exchange. The exchange capacity is not a constant quantity, but can be altered by a shifting of the bonds. The electronegative complexes give an exchange acidity with neutral salts, whereas the electropositive complexes give an exchange alkalinity. The point of exchange neutrality does not, however, coincide with the isoelectric point, but varies with the nature of the ions of the salt. The Donnan equilibrium shows the micellar atmosphere to consist of cations in the electronegative condition and of anions in the electropositive condition, but the cataphoretic and the Donnan isoelectric points do not appear at exactly the same pH."

Inter-relations between H-ion concentration, base exchange, and plant nutrient availability in soils (*Vermont Sta. Bul. 319 (1930), pp. 12, 13*).—"Fourteen soil samples were collected, representing some of the important Vermont soil types, including clays, heavy loams, sandy loams, and mucks. Their total acidities, pH values, organic matter, nitrogen, and colloid contents were determined. Correlation seems evident between the organic matter content, H-ion concentration, and base exchange materials. This would seem to indicate that an organic as well as an inorganic compound is involved, and to suggest that any system of farming tending to increase the soil organic matter content should serve to increase the soil content of these more or less unknown factors. . . . It would seem . . . that liming should indirectly increase the relative amount of this material through favoring plant growth and increasing the organic matter content."

Soil organic matter-temperature relationship in the eastern United States, H. Jenny (*Soil Sci., 31 (1931), No. 4, pp. 247–252, fig. 1*).—In correlating the organic matter content of surface soils from 18 counties in Maine, New York, New Jersey, Pennsylvania, and other States, including Florida, the

[1] Ceramics: Clay Technology, H. Wilson. New York and London: McGraw-Hill Book Co., 1927, p. 55.

author of this communication from the University of Missouri found that "with increasing temperature the organic matter content of the soil decreases exponentially."

The carbon-nitrogen ratio in relation to the accumulation of organic matter in soils, F. J. Salter (*Soil Sci., 31 (1931), No. 6, pp. 413–430, figs. 2*).—In the investigation here reported from the Ohio State University, it was found with respect to the Ellsworth silt loam soil used that "with a given carbon-nitrogen ratio the microorganic processes taking place in the soil are similar, regardless of the organic materials added; a ratio wider than 10 : 1 causes the loss of organic carbon from the soil; a ratio narrower than 10 : 1 leads to the saving of organic carbon; a wide ratio causes nitrate depression over several months, whereas a narrow ratio leads to the formation of nitrates; wide-ratio materials may be sources of energy for nitrogen fixation, but this nitrogen will not be available to crops until losses of carbon have narrowed the carbon-nitrogen ratio to about 10 : 1; applications of phosphates do not cause appreciably greater nitrogen fixation; sufficient nitrogen to narrow the ratio to about 15 : 1 favors nitrogen fixation."

The stimulation of Lemna major by organic matter under sterile and non-sterile conditions, N. A. Clark and E. M. Roller (*Soil Sci., 31 (1931), No. 4, pp. 299–309, pl. 1, fig. 1*).—It is reported from the Iowa State College that *L. major* has been grown for a number of years in a purely inorganic medium under nonsterile conditions, and that the rate of reproduction in such cultures was increased by the addition of small amounts of extracts from manures and other organic substances, although the inclusion of the organic matter increased the number of microorganisms. Among the methods used in attempting the production of sterile cultures were irradiation with ultra-violet light and the use of germicides. The sterilization was finally accomplished by a method involving the use of potassium mercuric iodide and calcium hypochlorite. In the sterile cultures the organic extractives, which had been found to stimulate the nonsterile cultures, either had no effect or caused a depression in the rate of reproduction. On reinoculating the sterile cultures, stimulation by organic matter occurred as before. The growth of the sterile plants was always somewhat faster, however, than was that of the nonsterile in the inorganic medium used. The effect of bacteria introduced in pure culture increased in some cases and in others did not affect the rate of reproduction. The pure organic compounds tried stimulated neither the sterile nor the nonsterile cultures.

Sampling market-garden soils for nitrates, J. E. Blaney and J. B. Smith (*Soil Sci., 31 (1931), No. 4, pp. 281–290*).—This contribution from the Rhode Island Experiment Station reports the determination of nitrate nitrogen in 40 cores of soil from manured, limed, and fertilized soils under drilled market-garden crops. The uniformity of nitrate distribution in sets of samples taken from fallow and from under small spinach, half-grown spinach, half- and full-grown beets, and half-grown celery, as shown by the usual statistical constants, was found to be "markedly less than that noted by other workers for fallow and for timothy sod." It was shown that a minimum of 50 borings each must be made in $\frac{1}{10}$-acre plats of drilled vegetable crops to insure the reduction of the probable error for nitrate nitrogen to approximately 5 per cent of the mean.

Conservation and availability of the nitrogen in farm manure, A. F. Heck (*Soil Sci., 31 (1931), No. 5, pp. 335–363, figs. 5*).—This contribution from the University of Wisconsin reports a laboratory and greenhouse study of the changes, losses, and availability of the nitrogen in farm manure.

When manure was stored under anaerobic conditions two changes took place, namely, the urea and water-soluble nitrogen changed to ammonia, and an acid fermentation took place with the formation of volatile organic acids which reacted with the ammonia, forming salts.

The losses of nitrogen from farm manure appeared in both the storage and handling processes. Under extreme conditions these losses combined were almost one-half of the total nitrogen or nearly the whole of the liquid manure nitrogen. The loss of nitrogen was due to the volatilization of ammonia either as the carbonate or as the salt of a volatile acid. The former seemed to be lost most rapidly during the early drying period and the latter when most of the carbonate was gone. The ammonification process resulted in an increase in the pH value and the fermentation process caused the pH value to decrease. This decrease was in direct proportion to the amount of straw or energy material present.

When liquid manure was stored alone, the nitrogen changed to ammonium carbonate and was lost from the solution by volatilization. This loss could be reduced to almost nothing by covering the surface of the liquid with a thin layer of mineral oil. Even when the container was open, there was practically no loss of nitrogen through the oil layer.

Straw as bedding in the manure tended to reduce the drying losses of nitrogen, but at the same time it reduced the availability of manure nitrogen.

"An approximate measure of the nitrogen available from farm manure is obtained by the difference between the water-soluble or ammonia nitrogen and the losses of nitrogen from the manure during storage and handling. If there is no loss of nitrogen from cattle manure, 50 per cent of the total, or 100 per cent of the liquid, manure nitrogen should be recovered in the first crop under normal conditions. A smaller recovery than this is probably due either to loss of liquid manure nitrogen or the use of excessive amounts of straw as bedding."

The availability of the nitrogen in farm manure under field conditions, A. F. HECK (*Soil Sci., 31 (1931), No. 6, pp. 467–481, pl. 1, figs. 2*).—Report is made of field and laboratory work carried out at the University of Wisconsin and leading to the following among other observations and conclusions:

"The amount of nitrogen recovered in the barley crop was never greater than the amount of ammonia or liquid manure nitrogen applied. The results indicate that only the ammonia or liquid manure nitrogen is available for the first crop after the manure is applied to the soil. Little if any of the water-insoluble nitrogen in the manure is recovered in the first crop. . . . Complete manure turned under immediately on spreading gives a recovery of 80 per cent of the urea or ammonia nitrogen which it contains. There is no difference in the availability of nitrogen between the manure fermented in storage and the fresh manure when they are turned under immediately on spreading. . . . Measured in terms of nonrecovery, the greatest loss of nitrogen in spreading manure and allowing it to dry or partially dry before being plowed under occurs with manure which has ammonified but not fermented. The next greatest loss is from the completely fermented manure. The fresh manure gives a still smaller loss under these conditions, and where the fermented manure is spread just previous to a rain the loss from drying is not more than a few per cent. The better the conditions for drying and the greater the proportion of the nitrogen in the form of ammonium carbonate, the greater the loss of nitrogen in handling, spreading, and subsequent drying. . . .

"Conditions which give a nitrification curve most similar to the growth curve of the plant and furnish sufficient nitrogen for rapid growth during the

seedling and tillering stages are most conducive to high yields and the greatest recovery of manure nitrogen."

The dehydration of cow manure, J. F. Muller (*Agr. Engin., 12 (1931), No. 5, pp. 149, 150, fig. 1*).—The results of experiments on the dehydration of cow manure in connection with the industrialization of milk production are presented. These resulted in the development of a direct-heat, rotary drum drier of the conventional type, with the modification of having the wet material enter in the furnace end and travel along the drum in the same direction as the hot gases, as opposed to the usual countercurrent principle.

The temperature in the furnace reaches about 2,600° F. and at the intake in the drum from 1,800 to 2,000°. The amount of heat and the feed are so regulated as to maintain a temperature of about 400° at a point about 5 ft. from the outlet, this giving a final product of about 12 per cent moisture content.

Copper as an essential for plant growth, A. L. Sommer (*Plant Physiol., 6 (1931), No. 2, pp. 339–345, figs. 3*).—Considering the work at the Florida Experiment Station of Allison, Bryan, and Hunter (E. S. R., 58, p. 209) inconclusive with respect to the necessity for copper in the growth of plants, the author made solution culture experiments with sunflowers, tomatoes, and flax, which are here reported as showing normal growth of seedlings in culture solutions containing as little as 0.06 mg. of copper per liter as compared with very limited growth or death of the plant in culture solutions containing no copper. In the case of the tomato plants the largest culture produced "142.2 gm. of green matter as compared with 12.8 gm., the weight of the largest culture without copper." Similar effects of minute proportions of copper in solution were reported in the experiments with sunflowers and with flax.

Further evidence concerning the toxic action of aluminum in connection with plant growth, B. E. Gilbert and F. R. Pember (*Soil Sci., 31 (1931), No. 4, pp. 267–273*).—This contribution from the Rhode Island Experiment Station presents (E. S. R., 60, p. 318) further evidence indicating that in soil and solution cultures "active" aluminum has an inhibitory effect upon the growth of lettuce and of barley plants greater than that of acidity. In solution cultures ranging in pH value from 3.2 to 7.5 Cos lettuce seedlings were shown to be free from appreciable difference in dry weight yields, although in similar solution cultures to which aluminum sulfate had been added much depression of yield was demonstrated. It was further shown also that the dry weight yields of barley plants grown in samples of acid soils from several soil types of widely separated geographic origins were correlated more closely with the active aluminum content of these soils than with their respective acidities. The soils employed in these investigations included Merrimac silt loam (Rhode Island), Taugwank loam and Hollis silt loam (Connecticut), Sassafras silt loam (New Jersey), and Muscatine silt loam (Illinois).

Commercial fertilizers, L. S. Walker and E. F. Boyce (*Vermont Sta. Bul. 320 (1930), pp. 24*).—In addition to the usual fertilizer analyses and purchasers' information, this bulletin notes that "96 per cent of the brands licensed were 'high-analysis' goods (14 per cent or more of plant food)," further calling attention to the fact that "the average high-analysis goods contained about 60 per cent more plant food than did the average 'low-analysis' goods, but it cost only 38 per cent more, hence it was much the cheaper."

A half century of fertilizer control in Vermont, J. L. Hills (*Vermont Sta. Bul. 323 (1930), pp. 40, figs. 2*).—Following a historical introduction, the developments of the period covered by fertilizer control work in Vermont are treated under the following among other headings: The beginnings of control work in the United States; early fertilizer control work in Vermont; Vermont

Station publications dealing with commercial fertilizers; volume and cost of control work; the fertilizer trade in Vermont from 1872 to 1930; companies selling in Vermont; miscellaneous fertilizers; crude stocks; florists' goods; sheep, goat, and hen manures; limes; ancient trade practices now discarded; and the evolution at this station of the alkaline permanganate method of determining the activity of organic nitrogen.

Interpretation and popular presentation of data showing the economic results of fertilization, H. W. WARNER (*Jour. Amer. Soc. Agron., 23 (1931), No. 4, pp. 266–270*).—Ways of interpreting and presenting results of fertilizer experiments are described.

AGRICULTURAL BOTANY

Longevity in plants, H. MOLISCH (*Die Lebensdauer der pflanze. Jena: Gustav Fischer, 1929, pp. VIII+168, figs. 39*).—A 10-year study is presented of plant longevity considered from various viewpoints.

Growth of seedlings in light and in darkness in relation to available nitrogen and carbon, M. E. REID (*Bot. Gaz., 87 (1929), No. 1, pp. 81–118, pls. 4*).—This is a report of investigations regarding the influence of types of reserve foods upon the development of the seedling, and specifically concerning the relation to growth of the amount and nature of the reserves of carbon and nitrogen at the disposal of an embryo plant.

It is stated that growth of the seedling is influenced by the nature and relative amounts of the food reserves of the seed, as well as by differnces in the external environment as light and darkness and the presence or absence of nitrates in the nutrient solution. When the seedlings have been grown without nitrogen from an outside supply, it has been found that seeds having a high-nitrogen and low-carbon content produced seedlings having a large top in proportion to the roots; that seeds having a low-nitrogen and high-carbon content produced seedlings with relatively small top compared to size and weight of the roots; and that seeds showing intermediate proportions of their reserves of carbon and nitrogen gave seedlings having intermediate proportions of shoots to roots. The shoot or root weights produced by various plant seedlings in correspondence with different reserve foods in light or in darkness are tabulated.

Nitrates are synthesized into growth-promoting substances in darkness but much more rapidly in the light, and they favor the growth of shoots more than of roots. Light greatly favors root growth. Seedlings developed from high-protein seeds benefit most from the influence of light, the roots and leaves being larger, more numerous, and much heavier than in case of seedlings grown in darkness. This is true of high-protein seedlings grown with or without extra nitrogen, but the effect is greater in case of the latter. Seedlings grown from low-protein seeds without extra nitrogen show less influence from light as to weight of different organs. Leaves of very low-protein seeds grow even less in light than in darkness. If extra nitrogen is supplied, these seedlings also benefit by the influence of light. Seedlings with limited nitrogen supply undergo rapid differentiation and maturing of tissues in the light. The lower the nitrogen content of the seed, the more rapid the process. Light favors secondary thickening in stems and roots and deposition of strengthening materials in the cell walls. The responses as to the effect of varying amounts of reserve carbon and nitrogen on seedling growth agree with results obtained with tomato cuttings having similar (though in some cases more extreme) variations in composition of the reserves.

Root formation and flowering of dahlia cuttings when subjected to different day lengths, P. W. ZIMMERMAN and A. E. HITCHCOCK (*Bot. Gaz.*, *87* (*1929*), *No. 1*, *pp. 1–13*, *figs. 6*).—Reporting the ranging response of cuttings from six varieties of dahlia after subjection to different day lengths, the authors state that the length of day tends to determine the type of root system formed, heavy root storage being correlated with a short day and a fibrous root system with a long day. Flowering was independent of storage root formation although certain varieties flowered and formed storage roots concurrently on a short day, other varieties flowered independently of day length, and still others flowered only in response to a short day.

Cuttings taken during late September and October developed various types of storage organs along the stem without showing either fibrous or typical storage roots. Nitrates accumulated in leaves and stems of stort-day plants, but little, if any, accumulated in long-day plants. The H-ion concentration of stems and leaves of long- or short-day plants varied but slightly from pH 5.4.

A spectrophotometric study of reflection of light from leaf surfaces, C. A. SHULL (*Bot. Gaz.*, *87* (*1929*), *No. 5*, *pp. 583–607*, *figs. 10*).—A critical review of related work previously done is given, with an account of materials, methods, and results in the present work. On account of differences or variability in leaf color and texture, many different kinds of leaves were selected, mainly from woody vegetation, trees, and shrubs, including *Ulmus americana*, *Betula alba*, *Acer platanoides*, *Syringa vulgaris*, *Psedera quinquefolia*, *Populus alba*, *Prunus pissardi*, *Cersis canadensis*, *Aesculus hippocastanum*, *Sassafras varii-folium*, *Castanea dentata*, *Liquidambar styraciflua*, *Catalpa bignonioides*, *Morus rubra*, *Ginkgo biloba*, *Tilia americana*, and *Magnolia acuminata*, and among the herbaceous forms *Zea mays*, *Xanthium italicum*, *Arctium minus*, *Verbascum thapsus*, *Abutilon theophrasti*, and *Asclepias syriaca*. In many cases the reflection was measured from both leaf surfaces.

The reflection of light at normal (90°) from the surfaces of many kinds of leaves was measured by means of a direct reading spectrophotometer, the incident light making also all other angles with the leaf.

The amount of reflection varies on account of the wave length, the maximum reflection showing usually at a wave length of from 540 to 560 mμ in green leaves. The value of the reflection in this region ranges from 6 to 8 per cent in the darkest green leaves to from 20 to 25 per cent in the lightest green specimens. Neither hairiness nor smoothness necessarily means high reflection. The total of reflection decreases with the age of the leaf, somewhat in relation to the chlorophyll development. The presence of whitish objects, as in the case of mildew, increases leaf reflection very noticeably. Anthocyanin development is accompanied by a shift in the position of maximum reflection to longer wave lenths. In some cases a depression of the reflection curve at 680 mμ obviously corresponded to the maximum absorption band of chlorophyll, this fact supposedly arguing some reflection from the internal surfaces.

The data here presented, though considered as of value in connection with the problem of income and outgo of energy in the leaf processes, must be supplemented, it is thought, with measurements in the invisible regions of the spectrum, particularly the infra-red region, before a complete accounting of the energy utilization can be rendered.

Quantitative differences in palisade tissue in citrus leaves, F. F. HALMA (*Bot. Gaz.*, *87* (*1929*), *No. 2*, *pp. 319–324*).—These data are believed to warrant the conclusion that in healthy mature leaves of every citrus species or variety examined the ratio of depth of palisade tissue to leaf thickness is nearly constant. Leaves of the lemon group show a value which is about 20 per cent

higher than that for orange. Grapefruit ranks below orange, and Satsuma shows the lowest value. A discussion is given of the close relationship which is apparent between the degree of palisade development for each species and its growth rate.

Composition of walnut trees as affected by certain salts, A. R. C. Haas (*Bot. Gaz.*, *87* (*1929*), *No. 3*, *pp. 364–396*, *figs. 3*).—In a study of the influence of saline irrigation water, made upon walnut trees with reference to the effects upon behavior and growth and upon the relationship between inorganic constituents, it was found that the continued application of such water to the tanks of soil-rooted walnut trees resulted in the reduction in size of the leaves with occasional leaf burn, but no mottle leaf or yellows. A gradient exists in the ash content of the dry matter of walnut trees, which shows its minimum in the rootlets in good soil but in saline soil near the level of the soil surface.

The production of a new cycle of growth initiates changes in the relationships of inorganic constituents of the water-soluble and the insoluble fractions of the dry matter. Changes in relations are detailed. Saline soils affect the inorganic constituents of husks and kernels as well as those of the trunk, shoots, and leaves. The effects of artificially made soils upon trees and fruit relate to accumulations of chlorine and sulfur, also equally to changes in relationships between bases within the tissues. Salinity artificially made in controlled tank cultures effected reduction rather than increase of the ash content in aboveground portions. Direct sunlight caused an increase in dry matter ash constituents. This may cause, in coincidence with extreme temperatures, burning of the husks with resultant loss of marketability.

Absorption from salt solutions by short shoots with young walnuts attached increased the sodium content of the kernel. The pH in the juice of young (still liquid) walnut kernels was about 5.2, and such juice was extremely rich in inorganic constituents.

On the behaviour of " anthocyanins " at varying hydrogen-ion concentrations, B. H. Buxton and F. V. Darbishire (*Jour. Genetics*, *21* (*1929*), *No. 1*, *pp. 71–79*, *pl. 1*, *fig. 1*).—Anthocyanins of colored flowers are differentiable into two main groups, here called for convenience the blue and the red. The anthocyanin of the blue group is a lake red at pH 3, passing through pink and violet to blue at about pH 7, and to green at the alkaline end of the series; the green being due to influence on the blue of flavones, which are yellow in alkaline media. The anthocyanin of the red group is a vermilion red at pH 3, passing through the shades of red and pink to brownish purples in the more alkaline media. No blue or green appears at any pH value. Brownish tints are produced by the presence of yellow flavones.

Intermediate shades are purple to magenta or pink and contain for the most part both blue and red anthocyanins in varying proportions.

It is thought unnecessary to assume that the sap of the purple or red flower is more acid than that of the blue flower, although in some cases the blue pigment alone may be present, but may appear violet or purple-red on account of the sap acidity.

The penetration of furfural in plant tissues, M. F. Howe and D. Cation (*Phytopathology*, *18* (*1928*), *No. 1*, *p. 152*).—Technical furfural painted on the stems of tomato plants from which a small area of the epidermis had been removed caused yellowing and flagging of the leaves and a shriveling of the stems. High concentrations of furfural are markedly toxic to the green living stem and leaf tissue of herbaceous plants. The rate of penetration through the vascular bundles is six times as rapid as that of water, and that through

woody stems is from four to nine times as rapid as water, the variation in rapidity depending largely upon the wood type. Woody tissues, as those of red oak and hard and soft maple, absorbed from one and one-half to twice as much as the amount of water. The amount absorbed by weight of furfural diluted with water (up to 7 per cent) gave no conclusive evidence that the water materially decreased the absorption of furfural. Green apple, dry apple, dry hickory, and dry red oak absorbed less water in a given length of time than furfural, creosote, kerosene, and a creosote-furfural mixture.

The mycorrhizal fungus of Vaccinium, K. D. DOAK (*Phytopathology, 18 (1928), No. 1, p. 148*).—A nonpathogenic fungus was found producing an endotrophic mycorrhiza in different soils within roots of *V. corymbosum*, *V. vacillans*, and *V. pennsylvanicum*.

Though normal root and stem development did not depend upon the presence of the fungus, a profuse growth of it around the roots of seedlings was not detrimental, and the addition of roots already possessing the fungus to unsterilized sphagnum peat and leaf mold appeared advantageous. No evidence of direct nutritive symbiosis occurred.

An inexpensive and quickly made instrument for testing relative humidity, W. B. SHIPPY (*Bot. Gaz., 87 (1929), No. 1, pp. 152–156, figs. 3*).—"The instrument described can be used for testing relative humidity within solid media. . . . One may test with this instrument the relative humidity of large or small volumes of air, 5–10 liters being sufficient for a reading. The size and shape of the instrument make possible its insertion through small openings, such as the hole in the lid of a desiccator or the top of a bell jar. Thus readings can readily be made out of doors or within constant condition chambers of large or small size. In addition to a rather wide use as a tester of humidity, it has the dependability of the sling psychometer. It may be quickly constructed in any laboratory and is made of standard equipment in common use."

GENETICS

The reign of probability, W. WEAVER (*Sci. Mo., 31 (1930), No. 5, pp. 457–466*).—This is a brief discussion of the theory of probability, especially its content and significance.

A third alternative: Emergent evolution, R. K. NABOURS (*Sci. Mo., 31 (1930), No. 5, pp. 453–456*).—The more acceptable explanation of emergent evolution than the doctrines of vitalism and mechanism is set forth.

Heredity and environment, A. F. BLAKESLEE (*Sci. Mo., 31 (1930), No. 6, pp. 556–559*).—This is a discussion of the interdependence of heredity and environment in molding qualities of the individual with special reference to humans.

The theory of dominance, E. B. FORD (*Amer. Nat., 64 (1930), No. 695, pp. 560–566*).—The author discusses the theory of dominance, supporting the hypothesis advanced by Fisher (E. S. R., 62, p. 28).

Cyto-genetics and the species-concept, E. B. BABCOCK (*Amer. Nat., 65 (1931), No. 696, pp. 5–18*).—An attempt is made to formulate a concept of species, and the contributions of genetics and cytology to the species problem are considered in some detail.

Studies in the cytology of the Hibisceae, II, III, W. YOUNGMAN (*Ann. Bot. [London], 45 (1931), Nos. 177, pp. 49–72, pl. 1, figs. 9; 178, pp. 211–227, pl. 1*).—Two additional contributions to the series (E. S. R., 58, p. 320) are presented.

II. *The behaviour of the nucleus during cell-division in the root-tip of Thespesia populnea and comparative observations of the phenomena in some*

related plants.—The nuclear phenomena described were investigated in detail in the root tip cells of *T. populnea*, with parallel observations upon the nearly related *T. macrophylla*. Also other sets of observations were made in the allied genera Fugosia (Cienfuegosia) and Gossypium.

III. *A study of the prophase of the nucleus of the pollen mother-cell of Thespesia populnea.*—The phenomena described have bearings on chromosome behavior in species of Gossypium.

On the inheritance of length and width of leaves in the barley [trans. title], B. Miyazawa (*Bul. Miyazaki Col. Agr. and Forestry, No. 1 (1929), pp. 14, fig. 1; Eng. abs., p. 8*).—The inheritance of the length and width of leaf was studied in several Japanese varieties of barley. The long leaf usually showed dominance over the short. Segregation occurred and forms homozygous for length appeared in F_2. All of the crosses studied seemed to differ by a single factor for length. The width of leaf showed intermediacy in F_1 in almost all cases and seemed to segregate in a 1:2:1 ratio in F_2.

Heritable characters in maize.—XXXVI, A factor for soft starch in dent corn, W. J. Mumm and C. M. Woodworth (*Jour. Heredity, 21 (1930), No. 12, pp. 503–505, figs. 2*).—This is the thirty-sixth contribution to the series (E. S. R., 64, p. 24). Kernels on a starchy ear, selected at the Illinois Experiment Station from a line selfed for nine years and uniformly horny in endosperm composition, had a soft starch endosperm surrounded by a thin corneous layer of harder starch next the pericarp. The starchy type when selfed bred true for the character, which seemed probably the result of mutation, and was designated *h* and its dominant horny allelomorph *H*. The starchy character is not a defective type in any sense, the seed being as large and as viable as that of the dominant type on the same ear, the seedlings as vigorous, and the mature plants as productive. Thus far in tests the starchy type has been as resistant to scutellum rot as the horny type.

Inheritance studies of white-capping in yellow dent maize, [I], II, C. G. Kulkarni (*Mich. Acad. Sci., Arts, and Letters, Papers, 6 (1926), pp. 253–273; 13 (1930), pp. 111–129*).—A factor for white capping (*Wc*) of kernels in corn was found to be a simple dominant to yellow capping. White capping evidently is a condition of the endosperm due to the inhibitor *Wc*. Silver King appeared to carry a white capping factor not expressed in the absence of yellow endosperm.

Wc was shown to be dominant to dominant white endosperm (*Wh*) and yellow flint in F_1 and segregated in a monohybrid ratio in F_2 in both cases. White capping of all the varieties investigated was genotypically and phenotypically the same. *Wc* was found not to be linked with *C, sh, wx, g, su, Tu, B, lg, Pl, A, P, Ra, ws,* and *j*.

Inheritance and linkage relations of chocolate pericarp in maize, E. G. Anderson and R. A. Emerson (*Amer. Nat., 65 (1931), No. 698, pp. 253–257*).—Chocolate pericarp color in corn was found in Cornell University studies to be a simple dominant to colorless. Since no indications were had of linkage with the nine known linkage groups, the gene *Ch* was therefore submitted as representing the tenth linkage group.

A fertile triple hybrid, Nicotiana tabacum × (Nicotiana sylvestris × Nicotiana rusbyi): Preliminary report, D. Kostoff (*Amer. Jour. Bot., 18 (1931), No. 2, pp. 112, 113, pl. 1*).—Cytological studies at the University of Sofia showed that the partially fertile plants derived from the hybrid indicated had a relatively regular reduction division and usually 48 + 1 or 48 + 2 somatic chromosomes, while the fertile intermediate triple hybrids had normal regular reduction division and had 24 chromosomes in the pollen mother cells and

48 in the root tips. The origin of the two types of hybrids is explained on a cytological basis.

The inheritance of characters in rice, Part III, K. Ramiah (*India Dept. Agr. Mem., Bot. Ser., 18 (1930), No. 7, pp. [5]+211–227, pls. 10*).—The third contribution in this series (E. S. R., 49, p. 34) reports that the spreading habit in rice varieties, wherein the stems or tillers are spread out and inclined in varying degree from the vertical, was found to be a simple dominant to the compact habit where tillers bunch closely, maintaining a nearly vertical position. Weak young seedlings, having the first few leaves deficient in chlorophyll with a yellowish appearance and slower in growth than normal green, characterized strains sometimes produced in the progenies of rice crosses. The differences noted in early stages disappear later, and the leaves become green. This yellow behaved as a Mendelian recessive, the behavior explained by the combination of two recessive factors each producing identical results. A chimera involving glume color and other pigmentation and the effects of a lethal factor are noted.

Inheritance of flower colour in a cross between white blossom and yellow blossom sweet clover (*Melilotus albus* Desr. × *M. officinalis* (L.) Desr.), L. E. Kirk (*Sci. Agr., 11 (1931), No. 5, pp. 265–273*).—In a cross between *M. alba* and *M. officinalis* (E. S. R., 60, p. 429) studied at the University of Saskatchewan, the F_1 plant had cream or pale-yellow colored flowers, and an F_2 progeny consisted of 150 plants of which 11 were white in flower color, 18 dull white, 54 light cream, 55 dark cream, and 12 yellow. These frequencies agreed closely with a three-factor hypothesis, assuming two factors for cream, C_1 and C_2, which together give yellow, and a factor W from the white-flowered parent which inhibits the action of C_2. It was assumed also that C_1 has a greater effect in producing cream color than C_2. In general F_3 data supported the hypothesis, although yellow plants were deficient in most families where expected.

A chromosomal chimera in tobacco, D. Kostoff (*Jour. Heredity, 21 (1930), No. 10, pp. 445–448, figs. 3*).—Somatic nondisjunction and doubling of chromosomes in one of the progeny of the back-cross [*Nicotiana glauca* (n=12)×*N. langsdorffii* (n= 9)]×*N. langsdorffii* are described from studies at the Sofia (Bulgaria) University.

Chromosome numbers in angiosperms, II, L. O. Gaiser (*In Bibliographia Genetica. The Hague: Martinus Nijhoff, 1930, vol. VI, pp. 171–466*).—The present list of chromosome numbers supplements a previous list (E. S. R., 56, p. 816) with results of investigations reported between 1925 and the end of 1928. All older references previous to 1925 are included, with additions and corrections to the earlier list. A comprehensive bibliography is appended.

Variation in fungi and bacteria, W. B. Brierley (*Internatl. Cong. Plant Sci., Ithaca, N. Y., Proc., 1926, vol. 2, pp. 1629–1654*).—In the detailed and summarized account here presented, an introductory survey of the present position is followed by a brief critique of genetic phenomena, concepts, and terminology in groups of organisms other than bacteria and fungi. These two groups are then considered, and a critical analysis is made of the phenomena of variation that have been described. Correlations are discussed. Fungi and bacteria are compared with other groupings. Consideration is finally given to the avenues and directions of genetic research on fungi and bacteria, and the possibilities and limitations of such research.

The polyphyletic origin of cattle.—Historical study [trans. title], A. B. Szalay (*Ztschr. Zücht., Reihe B, Tierzücht. u. Züchtungsbiol., 19 (1930), No. 2, pp. 165–262*).—Various theories on the origin of races of cattle are reviewed.

Black spotting and milk production [trans. title], E. LAUPRECHT (*Züchtungskunde, 5 (1930), No. 10, pp. 435–441*).—The milk production and fat percentage in the milk of cows from a number of sources were classified according to three grades of color. It was found that there was no relation between the color of the animals and the fat contained in the milk, but that the milk production of the darker colored cattle was greater than that of the more pied animals.

Temperature effects on the color of the Siamese cat, N. A. and V. N. ILJIN (*Jour. Heredity, 21 (1930), No. 7, pp. 309–318, figs. 7*).—A study of pigmentation in the Siamese cat showed it to be related to temperature. Kittens on which the hair develops in a warm intrauterine temperature are white, but the succeeding coat is darkened due to its development under a lower environmental temperature. Dark areas were changed to light areas by bandaging or by irritation of the areas over which new hair was developing. Different parts of the body had different thresholds of irritation to pigment production, accounting for the peculiar pattern in Siamese cats. Analogy is drawn between the color behavior in the Siamese cat and the Himalayan and Marder rabbits.

The "frizzle" character of fowls, W. LANDAUER and L. C. DUNN (*Jour. Heredity, 21 (1930), No. 7, pp. 290–305, figs. 7*).—In studies at the Connecticut Storrs Experiment Station of the frizzle character in fowls, three types of frizzling were identified, (1) the exhibition type, which shows a high degree of curling of the body feathers with ragged wing and tail feathers; (2) Frizzles from crosses of Frizzles with normal breeds, which show a lower grade of frizzling; and (3) homozygous Frizzles, which are more or less devoid of feathers during the first year.

Microscopic studies of the character of the feathers showed that the barbules were thickened and many of the hooks were missing, and that the barbules were placed at a more acute angle with the shaft of the feathers than in case of normal feathering. These abnormalities were more pronounced in homozygous birds than in heterozygous fowls.

Genetic studies demonstrated that a single pair of factors accounted for the difference between the frizzled and nonfrizzled character of the feathers. Frizzling was dominant. Exhibition frizzled birds were generally heterozygous because of the low viability and undesirable character of the bare homozygous birds. There was no recessive lethal action of the frizzle gene, but embryonic mortality was high and hatchability low if females of the exhibition type or homozygous females were used, even when mated with normal birds. This is explained as due to the higher metabolic rate, lowering the storage material deposited in the egg. The frequent sterility of homozygous birds is accounted for on the same basis.

A statistical study of factors affecting egg weight in the domestic fowl, D. R. MARBLE (*Poultry Sci., 10 (1930–31), No. 2, pp. 84–92*).—The results are given of a study of simple and multiple correlations between egg weight and 10 other variables as observed in the high and low lines of birds bred at the New York Cornell Experiment Station from 1917 to 1928. The high line was divided into two groups for analysis, one up to 1925, and the other from 1925 to 1928. The independent variables were body weight, days to maturity, annual egg production, and egg weight of dam, sire's dam, dam's dam, sire's sire's dam, sire's dam's dam, dam's sire's dam, and dam's dam's dam.

The multiple linear correlations of egg weight with the other factors in the three groups were 0.5798±0.0160, 0.5460±0.0285, and 0.6481±0.0297. The single factor which appeared to be of primary importance was body weight, which accounted for from 19 to 32 per cent of the variability in egg weight in the

different groups. By bringing in the curvilinear influence of body weight, days to maturity, and annual egg production the multiple correlation of 0.5798 was increased to 0.6415±0.0142.

Apparently there were many undetermined factors influencing egg weight which were not included in the study.

Effect of ovarian injury on date of first egg in fowls, M. Steggerda (*Poultry Sci., 10 (1930–31), No. 2, pp. 98–103*).—In studies of the influence of ovarian injury on egg production the ovaries of 25 6-weeks-old pullets were mutilated with a hook, while the ovaries of 25 similar birds were partially removed. Fifty birds having the abdominal cavity opened were reserved as controls. The operated birds showed a much greater variability in the number of days after October 1 to the laying of the first egg than the controls. The average for the operated birds that survived was 66.6 days as compared with 70.9 days for the controls. This confirms previous studies of this nature (E. S. R., 60, p. 633).

The embryological biochemistry of the developing hen's egg, H. O. Calvery (*Sci. Mo., 31 (1930), No. 4, pp. 301–305*).—Attention is called to certain difficulties attending the biochemical studies of the development of the egg.

The development of pigment in cattle embryos, E. Esskuchen (*Ztschr. Zücht., Reihe B, Tierzücht. u. Züchtungsbiol., 19 (1930), No. 2, pp. 268–295, figs. 23*).—This deals with the development of pigment in cattle embryos based on histological studies of the skin of fetuses of different ages and chemical studies of pigment formation, including the influence of enzymes at different temperatures. At least two enzymes having different optimum temperatures appeared to operate. For one the optimum temperature was about 50° C. and for the other between 80 and 90°. The appearance of pigmentation in the embryo varied with the color. The first dark color was observed in black embryos at 11.5 weeks, and at 3.5 months the entire pattern could be determined. Reddish brown color did not appear until 7 months of gestation. The extremities, particularly the head, legs, and tail, were the first to show pigmented areas.

The causes of variation of embryos [trans. title], L. V. Kondyrev (Kondireff) (*Trudy Gosud. Inst. Èksper. Vet. (Oeuvres Inst. État. Méd. Vét. Expt. Moscou), 5 (1928), No. 1, pp. 109–120, figs. 9; Ger. abs., pp. 116, 117*).—A study of the variation in the weight, length, and breadth of hens' eggs laid by three different breeds showed that the variability was independent of the age of the hens. There was, however, a correlation of 0.42±0.03 between egg weight and the live weight of the hens, and a correlation of −0.49±0.10 between the length and breadth of the eggs. The variations in the character of the eggs were attributed to genetic factors and to the condition of the female as a result of environmental conditions.

The development, histology, and endocrine functions of the compensatory right gonad of the hen, J. C. Gray (*Amer. Jour. Anat., 46 (1930), No. 2, pp. 217–259, figs. 19*).—The removal of the functional ovary of the chicken results in a short time in the development of the rudimentary right gonad. The tubules formed at from 4 to 6 weeks after the operation resembled seminiferous tubules, but no germ cells were present. The connective tissue stroma also increases materially, but there were no cells present which resembled the interstitial cells found in the gonads of other vertebrates.

About 3 to 4 months are required for the hypertrophied right gonad to attain full size. It is covered with a thin, flat peritoneum and a relatively thick tunica albuginea, and is divided into lobes usually containing both tubules and cords. The tubules are generally lined with a single layer of epithelial cells. Certain peculiarities of the hypertrophied gonads are noted, including

cyst-like structures at the periphery. No connection between the gonad tubules and the rete were found.

A hypertrophied wolffian body was noted in a few cases.

A study of the mucosa of the genital tract of the cow, with special reference to the cyclic changes, H. H. Cole (*Amer. Jour. Anat., 46 (1930), No. 2, pp. 261–301, figs. 22*).—In investigations at the California and Minnesota Experiment Stations, the changes occurring in the mucosa of the genital tract during oestrum and pregnancy were studied in 31 cows killed at stages varying from prooestrum to the two-hundred-and-fifty-fourth day of gestation. The contents of the lumen of the vestibule and vagina are described, as well as the condition of the ovaries in a number of the animals.

During prooestrum and oestrum there was congestion of the blood vessels and edema of the stroma of the vestibule, and considerable extravasation of blood into the vagina proper during oestrum and postoestrum.

The most striking changes occurring in the mucosa were observed in the vagina 1 to 2 cm. from the cervix. During prooestrum the superficial epithelium consisted of large, wide, mucous-secreting cells beneath which there were 2 or 3 layers of polyhedral-shaped epithelial cells. During oestrum the epithelium was reduced to 1 or 2 layers, the superficial layer consisting of extremely tall, narrow, columnar mucous-secreting cells. Several layers again appeared at 2 days postoestrum. At 8 to 11 postoestrum the epithelium was vacuolar and somewhat degenerate. It appeared that mucus secretion began in the cervix and progressed toward the posterior portion of the vagina.

During heat there was congestion of the blood vessels and edema of the stroma in the endometrium of the uterine horns, and glandular hypertrophy became very marked at 8 to 11 days postoestrum. Ovulation had not occurred in 2 animals killed during oestrum, but had occurred 1 day postoestrum. Marked variation was observed in the size of the follicles in the ovaries of the pregnant animals.

Biological and chemical changes in cow's ovaries during pregnancy, G. F. Cartland, F. W. Heyl, and E. F. Neupert (*Jour. Biol. Chem., 85 (1930), No. 2, pp. 539–547*).—Analyses of the corpora lutea, the remainder of the ovary, and the ovary not containing the corpus luteum from cows during the first, second, and last third of pregnancy are reported. These studies show that the oestrum-producing hormone increased in the corpus luteum during pregnancy but decreased in the ovarian residue and in the blank ovary. The corpus luteum showed a decrease in the phospholipids and sulfolipids and an increase in the neutral fat as pregnancy advanced. There was no change in the cholesterol and cholesterol ester content of the corpus luteum.

The significance of sexuality, W. E. Castle (*Amer. Nat., 64 (1930), No. 695, pp. 481–494*).—Sexual reproduction is cited as an emergency measure to increase resistance to adversity by increasing the cell mass with relatively less surface. Genetically, lethal or harmful recessives may be concealed, and there is increased variability offering greater opportunity for the species to become adapted to changing environmental or social conditions.

Factors in the development of sex and secondary sexual characteristics, O. Riddle (*Physiol. Rev., 11 (1931), No. 1, pp. 63–106*).—A review of the literature bearing on the physiological basis of sex is presented. It is pointed out that sex as determined by the chromosome complex may be modified or even reversed by other conditions which appear to express themselves in a different oxidation level. As the males have a higher rate of metabolism, females show a greater storage of the metabolizable products. The differentiated gonads produce hormones acting on different organs or having different action

on the same organs, but the hormones of the testis and ovary are not antagonistic.

On some factors influencing sex ratio [trans. title], H. KRALLINGER (*Züchtungskunde, 5 (1930), No. 11, pp. 490–502*).—In 47,505 pigs of the Edelschwein and Improved Landschwein breeds, 50.57±0.23 per cent were males. Litters of individual sows and boars showed considerable variation, and it was concluded that individuals of both sexes carried factors which tended to modify the sex ratio. The smaller litters (2 to 10) showed 1.08±0.46 per cent more males than the larger litters (11 to 20). The season of the year of breeding did not show a definite relation to the fluctuations in the sex ratio, but the percentage of males in first litters appeared to be slightly greater than the percentage in succeeding litters, although the difference was not statistically significant.

The problem of the relationship between the number and the sex of human offspring, J. A. HARRIS and B. GUNSTAD (*Amer. Nat., 64 (1930), No. 695, pp. 495–508*).—Data from 998,761 German families were studied as to the relation between size of family and sex ratio. Several methods of analysis indicated that the proportion of boys increased slightly as the number of children per family increased.

FIELD CROPS

Principles of agrobiology or the laws of plant growth in relation to crop production, O. W. WILLCOX (*New York: Palmer Pub. Corp., 1930, pp. 96, figs. 53*).—Agrobiology is defined as "that division of agricultural science which considers the general external relations of crop plants to their environments, and their mass reactions to growth factors." It occupies a position intermediate between agronomy and plant physiology. The book deals successively with the ten primary laws of agrobiology, the general law of growth factors and its derivatives, and with fertilizer statics, or the maintenance of soil fertility. A mathematical appendix exemplifies the use of Mitscherlich and Spillman formulas in interpreting the data of vegetation experiments.

A mathematical study of the decrease of crop yields, J. D. GREAVES (*Soil Sci., 31 (1931), No. 2, pp. 115–122, figs. 21*).—In further tests of the equation for crop yield developed by Greaves and Gardner (E. S. R., 62, p. 418), the exponential integral was assumed to be a linear function of the time and the formula was tested on all available Rothamsted data with good confirmation. This tended to establish the two assumptions on which the formula was based: "The rate of increase of crop yield with increase of the deficient element is proportional to the magnitude of the deficiency of the limiting nutrient from an optimum concentration. The time rate of depletion of a deficient element, provided none is added from outside sources, is proportional to the product of the soil's content of the deficient element and the crop yield."

Report of the sub-committee [of the West Indian Conference of Agricultural Officers, 1930] on the standardisation of the lay-out of field experiments, J. S. DASH ET AL. (*West Indian Conf. Agr. Off., Trinidad, Proc., 1930, pp. 42–44*).—A further report on the standardization of the field experiments (E. S. R., 63, p. 442) deals with layouts for various tests with sugarcane and citrus fruits.

[Crops experiments in Rhode Island] (*Rhode Island Sta. Rpt. [1930], pp. 33, 34, 35, 36*).—Where potash carriers were compared, kainite and potassium chloride produced better yields of carrots, mangels, and tomatoes than di[illegible] [illegible] or double manure salt, although onion yields did not diffe[illegible]

between carriers. Potassium chloride and sulfate produced about equal yields of potatoes, and both surpassed kainite and double manure salt.

Grown as the uniform treatments, potatoes yielded best following oats, rye, squash, and redtop and least after cabbage and millet, mangels best following potatoes and squash, and least after mangels, and turnips highest following redtop and least succeeding turnips. Corn seemed to thrive less after itself than following any other crop.

Grasses (E. S. R., 61, p. 825) on plats alkaline in reaction grew most vigorously, especially early in the season but continued to be much weedier than on acid plats. Kentucky bluegrass was benefited by liming after the soil reached a pH of 4.5 to 5. Some of the bent grasses were much more prolific seed producers than others, and certain velvet bents seemed especially promising, both for turf and for seed production. The best seed crop of Rhode Island bent was obtained again with fertilizers high in nitrogen.

Northern-grown Irish Cobblers and Green Mountain potatoes outyielded in order seed home grown for one year and two years, respectively.

Dry-farming investigations in northeastern New Mexico, J. CARTER, JR. (*New Mexico Sta. Bul. 191 (1931), pp. 16, figs. 6*).—Experiments with field crops under dry-farming conditions were carried on from 1926 to 1930, inclusive, on experimental fields near Clayton, Capulin, and Mosquero, where the annual precipitation for the period averaged, respectively, 16.12, 17.54, and 16.78 in. and the frost-free periods 172, 130, and 166 days. Soil blowing during early spring is indicated as a serious problem to be controlled by better tillage practices.

The leading varieties included Hays Golden and Cassel White Dent corn at Clayton, White Flint at Capulin, and Freed White Dent and Swadley at Mosquero; Dwarf Yellow milo and Sunrise kafir at Clayton and Early Red kafir at Mosquero; Colsess and Club Mariout barley at Capulin; pinto beans; Blackhull and Kanred winter wheat; and Siberian and proso millet.

Early seed bed preparation for winter wheat was indicated from Mosquero field results, since moisture is limited during the winter and early spring months. While seeding dates vary with seasons, September seedings are advised when moisture is adequate for a stand. Spring barleys were promising at Capulin, whereas spring wheat was not successful. Forage sorghum is a sure feed crop for the dry farm, and indications were that alfalfa may be grown profitably if care be taken in selecting the land.

The improvement of grass land (*[Gt. Brit.] Min. Agr. and Fisheries Bul. 8 (1930), pp. 51*).—Practices suggested for increasing the produce of grassland in England and Wales, based largely on cited investigations in different parts of Great Britain, include culture, fertilization, and management of pastures and meadows, renovation, establishment of temporary and permanent grass and use of seeds mixtures. The merits of important grasses and clovers are indicated.

Irrigated alfalfa in Montana, J. E. NORTON (*Montana Sta. Bul. 245 (1931) pp. 27, figs. 6*).—Experiments with alfalfa under irrigation dealt with variety and cutting tests, sulfur applications, and the merits of alfalfa and grass mixtures for hay. General recommendations on cultural practice are also included.

The respective acre yields (1926–1928), proportion of leaves to stems, and crude protein contents (1928) were for the varieties Ladak 7.75 tons, 46.3 per cent, and 17.87 per cent; Baltic 7.63 tons, 43.3 per cent, and 16.23 per cent; Cossack 7.4 tons, 43.2 per cent, and 17.08 per cent; Grimm 7.06 tons, 42.8 per cent, and 16.42 per cent; Hardigan 7.05 tons, 44.4 per cent, and 16.67 per cent;

Ontario variegated 6.84 tons, 45 per cent, and 16.85 per cent; Montana common 6.66 tons, 42 per cent, and 16.01 per cent; Turkestan 6.28 tons, 44.1 per cent, and 16.22 per cent; and Argentine 6.07 tons, 44.9 per cent, and 19.03 per cent. Winterkilling did not affect Grimm, Cossack, Baltic, Hardigan, and Ladak appreciably during the years tested. Ontario variegated, not so resistant as these varieties, was more winter hardy than Montana common, which in turn surpassed Turkestan and Argentine. Variegated varieties were slower than Montana common in resuming growth after cutting, Ladak being especially slow to recover.

Grimm alfalfa during the period 1924–1928 when cut at one-half bloom averaged 6.18 tons per acre, 43.2 per cent leaves, and 16.82 per cent crude protein; one-tenth bloom 5.69 tons, 45.2 per cent, and 17.68 per cent; bud stage 4.93 tons, 51.9 per cent, and 19.63 per cent, and full bloom 4.5 tons, 39.9 per cent, and 14.78 per cent. When yield and quality of hay, labor distribution, and weather conditions were considered, harvesting alfalfa at first bloom (new growth stage) to one-half bloom seemed probably most feasible in the Gallatin Valley.

Mixtures of alfalfa and bromegrass returned higher yields than did alfalfa alone or alfalfa and timothy mixtures. A mixture of alfalfa and timothy did not yield significantly higher than alfalfa alone. Mixture with bromegrass was indicated where the hay cop was to be down for only two or three years; for longer periods a mixture of alfalfa and timothy should be used.

Application of sulfur to alfalfa at acre rates of 100, 150, and 200 lbs. did not increase the hay yield.

[Experimental work on cotton, 1928] (*Egypt Min. Agr., Cotton Research Bd. Rpt., 7 (1928), pp. 1–39, 49–55*).—The genetic, breeding, irrigation, cultural, fertilizer, soils, and technological investigations with cotton in Egypt during 1928 resembled in scope and often continued the research reported on for previous years (E. S. R., 61, p. 826).

The Ishan cotton plant under mixed cultivation, I, C. B. Taylor, E. H. G. Smith, and C. J. Lewin (*Nigeria Agr. Dept. Ann. Bul., 8 (1929), pp. 142–158, pls. 2*).—In cotton intercropped with yams, the yield, boll production, and flower production was depressed by about 30 per cent. Until the competitive effect of the yams ceased, the growth of the cotton plant was depressed about 30 per cent. Thereafter the intercropped plants recovered somewhat. Intercropping did not affect the shape of the plant, shedding, boll weight, period of maximum maturing, or lint length, but there was some evidence that intercropping depressed ginning percentage. The competitive effect of the yam plant was confined to a radius of 3 ft.

The yield and quality of cotton fiber and seed as influenced by soil conditions, F. C. Vilbrandt and J. R. Murphy, jr. (*Cellulose, 1 (1930), No. 5, pp. 142–144*).—The seed and fiber of Cleveland 884 cotton grown under a wide range of soil conditions in Scotland County, N. C., were studied at the University of North Carolina.

Fibers of cotton grown on light land or land badly washed by rain were $\frac{1}{16}$ to $\frac{1}{8}$ in. shorter than of cotton grown on stiff land and showed defective physical development. The nitrogen and oil content of the cottonseed appeared to be independent of the lint percentage, but where the soil conditions were the same the oil content of the cottonseed increased with the percentage of the normal fibers (good and medium). The nitrogen content seemed to be fairly constant, varying between 5 and 6 per cent in the samples studied, while the oil content varied between 20 and 34.4 per cent. The oil content of cottonseed would seem to be a better standard than the nitrogen content for determining the merit of cotton.

Flax and mineral fertilizers [trans. title], A. S. Mitrofanov (*Udobrenie i Urozhai, 2 (1930), No. 2, pp. 86–93*).—Fertilizer experiments with flax in various rotations on nonchernozem soils showed the best response to a complete fertilizer. Nitrogen was more effective in combination with phosphorus. Heavy applications of nitrogen and phosphorus depressed the yield and quality of fiber, especially the nitrogen. Potassium ameliorated this injury somewhat. No marked differences between the various sources of nitrogen or of potassium were observed. A light application of complete fertilizer on the crop following clover and preceding flax created a very favorable situation.

Some investigations into the effect of fertilizers on the growth and oil-content of a variety of linseed (Linum usitatissimum L.), A. Mohammad (*Agr. Jour. India, 25 (1930), No. 6, pp. 471–486, figs. 3*).—Flax (type 124) at Pusa Institute received sodium nitrate at 1 maund (82.3 lbs.) per acre, potassium sulfate 2 maunds, and superphosphate 2 maunds, alone and in combination. Sodium nitrate and complete fertilizer appeared to cause increases of 5 and 3 per cent, respectively, in the maximum height of plants and 6 and 4 per cent in seed yield as compared to the control, whereas potassium sulfate showed no effect and superphosphate a 5 per cent reduction in plant height and 6 per cent in yield. Sodium nitrate and complete fertilizer apparently caused 15 and 10 per cent, respectively, increase in the average number of basal branches per plant. Increase in height and in number of basal branches accompanied an increase in seed yield. The height of plants being the same, number of basal branches was positively correlated with yield. No remarkable effect on the oil content of the seed was shown by any of the materials applied. The percentage of oil content of one and the same type of flaxseed seemed to vary from year to year.

Standard descriptions of registered oat varieties, R. A. Derick (*Canada Dept. Agr. Bul. 147, n. ser. (1931), pp. 28, figs. 13*).—Varieties of oats accepted for registration in Canada by the Canadian Seed Growers' Association and described and illustrated include Banner, Victory, Alaska, O. A. C. 3, O. A. C. 72, O. A. C. 144, Abundance, and Gold Rain.

The identification of Phalaris tuberosa (syn. bulbosa) and Phalaris minor in seed samples and in the field, H. C. Trumble (*Jour. Dept. Agr. So. Aust., 34 (1930), No. 1, pp. 38–44, figs. 3*).—Distinguishing characteristics of the species are described from studies at the Waite Agricultural Research Institute.

Identification of potato varieties by chemical tests, A. Lauder and I. M. Robertson (*Scot. Jour. Agr., 14 (1931), No. 1, pp. 47–55*).—Confirmation of the results of M'Intosh (E. S. R., 60, p. 225) in experiments by Robertson showed the paracresol reaction with tyrosinase to be the most suitable test for investigation of chemical differences between potato varieties. A solution of paracresol in dilute sodium hydroxide gave best results, and since temperature affected the rate of reaction, measurements were made at 18° C. (64.4° F.).

The activity of the potato tyrosinase varied with the age of the tuber, being greatest at early growth stages and diminishing gradually as the plant matured. At the same stage of maturity size of tuber had no influence on enzyme activity. For any one variety the activity was constant when the tubers were mature, indicating the importance of using only mature tubers in the test. Within indicated limits, neither soil type nor reaction, locality, altitude, nor season influenced the reaction appreciably. The reaction was affected by disease or injuries to the stock, but not to any extent by storage when the tubers were kept at room temperature for a day before the test. The application of the method to important British varieties is detailed, and its limitations are indicated. Great Scot and Arran Chief, separated with difficulty by other means, could be distinguished by the reactions of the pectic substances present.

On the premature heading in paddy rice [trans. title], H. Terao and T. Katayama (*Jour. Imp. Agr. Expt. Sta., Nishigahara, Tokyo, Japan, 1 (1929), No. 1, pp. 25–40, pls. 3, figs. 2; Eng. abs., pp. 38–40*).—Premature heading in paddy rice, i. e., the seedlings set in the field develop a panicle abnormally in only a few weeks after transplanting, seemed to be increased by prolonging the seed bed period and increasing the seeding rate per unit area of seed bed. Artificial illumination of the beds retarded growth and premature heading. Variations in premature heading for given periods in the seed beds were closely correlated with the maturing periods of the varieties.

Studies in Indian oil seeds.—No. 4, The types of Sesamum indicum, D. C., K. Ram (*India Dept. Agr. Mem., Bot. Ser., 18 (1930), No. 5, pp. [3]+127–147, pls. 7, fig. 1*).—The fourth paper of this series (E. S. R., 62, p. 633) treats of the general biology of *S. indicum*, including the root system, flowering, pollination, fertilization, and hybridization; the classification and characteristics of types; and the economic aspects of the crop.

Comparative trials with sugar beets in Czechoslovakia, 1929 and 1930 [trans. title], J. Souček et al. (*Ztschr. Zuckerindus. Čechoslovak. Repub., 54 (1930), No. 22, pp. 217–233, figs. 2; 55 (1931), No. 23, pp. 243–283, figs. 5*).—Of a number of strains of domestic and imported sugar beet seed tested in different localities in Czechoslovakia in 1929, Kleinwanzleben N, Selecta-Praha, Dobrowice, and Schreiber SS in order gave the highest average yields of beets per unit area; Wohanka ZR, Gebrüder Dippe WI, Zapotil, and Debrowice led in average sugar content; and Kleinwanzleben N, Dobrowice, and Selecta-Praha produced the most sugar per hectare.

The experiments in 1930 showed Buszczyński NP, Gebrüder Dippe E, and Kleinwanzleben E to lead in beet yields, Sandomierská MP and MC and Udycz B in sugar content, and Buszczyński NP, Gebrüder Dippe E, Dobrowice, Kleinwanzleben E, and Gebrüder Dippe WI in sugar per hectare.

Proceedings of the Third Congress of the International Society of Sugar Cane Technologists, held at Soerabaia, 7th–19th June, 1929 (*Surabaya, Java: Algemeen Syndicaat Suikerfabrikanten, 1930, pp. VI+648, pls. 9, figs. 57*).—The sessions of the congress at Surabaya, Java, comprised general meetings and sectional meetings dealing with protective sugarcane quarantine diseases, insect pests, cultivation and field operations, varieties, and factory operation and chemical control.

Papers of special interest to agronomists included *Half a Century of Cane Growing in Java* (pp. 27–34), and General Remarks on Cane Cultivation and Field Operations in Java (pp. 232–239), both by V. J. Koningsberger; The Development of Selection and Breeding of the Sugarcane in Java, by J. Jeswiet (pp. 44–57); The Economic Advantages and Drawbacks of the Java Sugar Industry, by G. H. C. Hart (pp. 61–76); Irrigation—Plant and Organization: Its Importance for Java's Agriculture in General and for the (Java) Sugar Industry in Particular, by H. Gerber (pp. 77–87); Miller and Grower in Northern India, by N. Deerr (pp. 87–92); *Co-operation Between Field and Mill in Cuba*, by F. S. Earle (pp. 93, 94); *Report of the Committee on Quarantine Practice in Relation to Inter-Regional Movement of Sugar Cane Propagating Material*, by E. W. Brandes (pp. 103–105); Sugar Cane Restrictions, by H. A. Shaw (pp. 106–110); Cane Cultivation in Northern India, by N. Deerr and C. G. Atkins (pp. 227–231); Cultivation and Field Operations of Sugar Cane in Mauritius, by H. Tempany (pp. 239–243); Cultivation and Field Operations of Sugar Cane in Natal, South Africa (pp. 244–251), and A Field Trial of Certain Sugarcane Varieties (pp. 449–453), both by H. H. Dodds; Cultivation and Field Operations with *Sugar Cane in Fiji*, by H. F. Clarke (pp. 251–254); Cane Cul

vation in Queensland, by H. T. Easterby (pp. 254–259); Cultivation and Field Operations in Hawaii, by J. A. Verret (pp. 259–265); Tilling for Cane Planting in Java (pp. 265–271), and On Planting and Planting-Material in Java (pp. 283–288), both by J. van Dijk; The Tractor in Cultivation, by D. Sturrock (pp. 273–277); Manuring in the Sugar-Cane Cultivation of Java (pp. 296–302), and Field Experiments for the Sugar-Cane in Java and the Results Obtained (pp. 348–373), both by G. Booberg; The Decline and Renaissance of Louisiana's Sugar Industry—a Remarkable Economic Comeback, by A. H. Rosenfeld (pp. 317–324); A Comparative Study of Yields Obtained from Cane Cultivation in Hawaii, Java, and Mauritius, by J. D. de Spéville (pp. 326–337); Plot Arrangement and Some Results of Variety Tests in Louisiana, by G. Arceneaux (pp. 338–348); Report of the Committee on Varieties of Sugar Cane to the 3rd Congress of the International Society of Sugar Cane Technologists, by W. W. G. Moir (pp. 385–403); Short Remarks on the Cytology of Saccharum (pp. 403–408), and The Cytology of Saccharum (pp. 408–420), both by G. Bremer; On the Present State of Cane-Breeding in Java, by O. Posthumus (pp. 420–429); and Problems for the Sugar Cane Breeder (with Special Reference to Indian Conditions), by T. S. Venkatraman (pp. 429–449).

Seed colour markings in white flowered sweet clover Melilotus alba Desr., L. E. Kirk and T. Stevenson (*Sci. Agr., 11 (1931), No. 9, pp. 607–611, fig. 1*).—Seed with purple flecking or spotting, usually considered characteristic of *M. officinalis*, was found in *M. alba* at the University of Saskatchewan. The Arctic (*M. alba*) variety had about 1 per cent with spotted seed and a dwarf white blossom sweetclover 100 per cent. The character color markings on sweetclover seed appeared to be dominant over its absence. Color markings on sweetclover seed probably can not be regarded as conclusive evidence that the seed pertains to *M. officinalis*.

Studies in Gujarat tobaccos and their improvement, Part I, V. M. Majmudar (*India Dept. Agr. Mem., Bot. Ser., 18 (1930), No. 4, pp. [5]+89–125, pls. 8*).—The extent and methods of tobacco growing in the region are described, with notes on varieties and improvement and on inheritance and variation of characters in Gujarat.

Fertilizer experiments with tobacco in 1928, together with some observations on the effect of green manures [trans. title], J. van der Poel (*Meded. Deli Proefsta. Medan, 2. ser., No. 66 (1930), pp. 45; Eng. abs., p. 42*).—For a stand of 12,000 tobacco plants per acre the optimum applications per plant, based on length of leaves and market grade, were ammonium sulfate 5 gm., double superphosphate 4 to 5 gm., and potassium sulfate 1 to 2.5 gm., depending on the soil type. The green manures *Mimosa invisa* and *Crotalaria anagyroides* sometimes were beneficial, while in other cases a very unfavorable influence, especially after Crotalaria, was noted when the tobacco was planted about 2 months after cutting and forking in the legumes. The unfavorable effect sometimes was revealed in poor development of tobacco in the field, as well as in the beds, but always in shorter leaves. The lower leaves in particular were shorter compared with plants grown after a fallow with secondary jungle, as is common in Deli (E. S. R., 61, p. 332). However, the quality of the cured leaf was hardly affected.

The curing of tobacco [trans. title], P. A. Rowaan (*Meded. Deli Proefsta. Medan, 2. ser., No. 62 (1929), pp. 56, pls. 6; Eng. abs., pp. 50, 51*).—Tobacco curing methods used in Java and elsewhere are described, and controlled curing experiments with Deli wrapper tobacco are reviewed.

Control curing, both on laboratory and commercial scale, with constant temperature and humidity generally produced tobacco which was more even,

brighter, and of better quality than that obtained by the ordinary barn curing method. Good ventilation appeared of great importance. During the first stage of curing relative humidity should be rather high (about 85 per cent) and allowed to decrease afterwards. The temperature for curing Deli tobacco probably should not exceed 30° C. (86° F.). There was no difference in fermentation, and the burn of the tobacco was not influenced. Controlled curing required 4 to 5 days less than the 21 days usual in barns. The bibliography embraces 94 titles.

The influence on yield and grade of harvesting rusted wheat at different stages of maturity, F. J. Greaney (*Sci. Agr.*, *11* (*1931*), *No. 8*, *pp. 492–511*, *figs. 2*).—Rusted Marquis wheat in fields in Manitoba was harvested at several stages of maturity in 1927, 1928, and 1929 in studies by the Dominion Rust Research Laboratory. In each year cutting rusted wheat before fully mature significantly reduced the yield. Quality of grain, as indicated by weight per bushel and per 1,000 kernels, improved markedly when the plants were allowed to mature before harvesting, while the percentage of green and shrunken kernels was reduced. The kernel weights indicated that little or no filling of the grain occurred after cutting. In 1927 and 1929 particularly, when stem rust developed rapidly and its destructiveness increased as the wheat approached maturity, yield and quality of wheat harvested prematurely were significantly lower than in more heavily rusted wheat harvested at the normal time. Results in 1929 on plats dusted with sulfur showed distinctly that rust is an important factor in reducing yield and lowering the grade. Although harvesting wheat while immature to avoid hail and frost injury may be justifiable, there evidently is nothing to recommend cutting wheat early to avoid rust damage. For the largest yield and best quality of grain the results showed that heavily rusted wheat should be harvested when most kernels are in the hard dough stage, i. e., two or three days before fully mature.

The relation of wheat protein to baking quality.—II, Saskatchewan hard red spring wheat crop of 1929, R. K. Larmour (*Cereal Chem.*, *8* (*1931*), *No. 3*, *pp. 179–189*, *figs. 3*).—Further milling and baking tests (E. S. R., 64, p. 32), using 665 samples of hard red spring wheat grown in Saskatchewan in 1929, showed correlations between loaf volume and crude protein of wheat to be for the basic baking formula $r=+0.63\pm0.016$, the bromate formula with 0.001 per cent potassium bromate $+0.906\pm0.005$, and for the 50–50 blend with soft flour plus 0.001 per cent potassium bromate, $r=+0.838\pm0.008$. With values obtained by use of the basic formula the regression of loaf volume on protein of wheat is linear for samples having 7 to 14.9 per cent of protein, with the bromate results linear from 7 to 15.9 per cent, and with the blend bromate results linear over the whole range, namely, 7 to 19.3 per cent. For estimating relative strength the blend formula was effective over the whole range of protein, whereas the other methods failed in the higher protein classes.

Report of seed analyses, 1930 (*Penn. Dept. Agr. Bul. 496* (*1930*), *pp. 93*).—The germination, purity, and weed seed content are tabulated for about 1,260 samples of agricultural seed collected in Pennsylvania during 1930.

Agricultural seed; fifteen years of agricultural seed inspection, A. S. Lutman and J. L. Hills (*Vermont Sta. Bul. 322* (*1930*), *pp. 20*).—The outstanding results in the analysis for purity and germination are described by Lutman for 357 samples of agricultural seed collected from dealers in Vermont in 1930.

Surveying 15 years of seed inspection work in Vermont, Hills compares the situations existing before the seed law, during the operation of a rather ineffective law, and after the enactment of the uniform seed law, and makes suggestions as to seed purchase with due regard to seed origin.

Official Seed Testing Station for England and Wales: Twelfth annual report, A. EASTHAM (*Jour. Natl. Inst. Agr. Bot., 2 (1930), No. 4, pp. 393–407, figs. 2*).—The average germination and purity of 25,834 samples of agricultural seed received from different sources in these countries during the year ended July, 1929, are tabulated and discussed, and examination questions on the principles and practice of seed testing are appended.

The official seed-testing station: Record of operations for year 1929, N. R. FOY (*New Zeal. Jour. Agr., 41 (1930), No. 2, pp. 114–123*).—The average purity and germination are tabulated for 9,153 samples of agricultural seed tested at the New Zealand seed testing station at Wellington during 1929.

Control of fern and blackberry on hill country in Marlborough Sounds, A. G. ELLIOTT (*New Zeal. Jour. Agr., 41 (1930), No. 2, pp. 124–126*).—In the system developed by the Harvey Bros. at Manaroa, New Zealand, for the successful control of fern and blackberry, secondary growth is allowed to flourish for at least three or four years so that a good burn may be obtained. Burning is done during the first two weeks in March. All large bushes of blackberry are cut to permit sheep to get among the burnt sticks to graze on young shoots and surface sown grass. Up to 12 lbs. per acre are sown of a mixture of orchard grass, danthonia, Chewing's fescue, perennial ryegrass, crested dog's-tail, and white clover. Depending on the season, the pasture is grazed lightly with yearlings about two months after seeding and the stocking increased until the growth is held.

Control of ragwort and other weeds by spraying, J. W. DEEM (*New Zeal. Jour. Agr., 40 (1930), No. 5, pp. 291–294, fig. 1*).—Complete kill was obtained by properly spraying ragwort, pennyroyal, St. Johnswort, ox-eye daisy, and similar soft weeds with solutions of sodium chlorate and calcium chlorate. A solution strength of 3 to 5 per cent is advised, according to the age of the plants, being best applied when the weeds are young. Solutions up to 5 per cent did not harm grass much, although stronger solutions and dry applications caused considerable burning.

A new noxious weed: Three-cornered garlic (Allium triquetrum), E. W. PRITCHARD (*Jour. Dept. Agr. So. Aust., 34 (1930), No. 5, pp. 518, 519, figs. 2*).—An escape from garden culture, three-cornered garlic is reported widespread in South Australia pastures and unpalatable to stock. Thorough eradication by pulling up the clumps by hand and burning them is advised, or if the stand is too extensive for profitable hand pulling, clean fallow for one or two years is suggested.

The anatomy of Convolvulus arvensis, wild morning-glory or field bindweed, P. B. KENNEDY and A. S. CRAFTS (*Hilgardia [California Sta.], 5 (1931), No. 18, pp. 591–622, figs. 27*).—The growth habits, growth and structure, and anatomical variations in the structure of the stem and root of morning-glory are described and illustrated. The phases treated form the background for a physiological study aimed at the development of a basic method for control of the weed (E. S. R., 64, p. 33.)

Prickly pear and its eradication, C. H. VAN DER MERWE (*Union So. Africa Dept. Agr., Sci. Bul. 93 (1931), pp. 32, figs. 19*).—Practical information is given on the characteristics, areas infested in South Africa, and control methods for pest species of Opuntia.

Eradication of yacca (Xanthorrhoea semiplana), R. HILL (*Jour. Dept. Agr. So. Aust., 34 (1931), No. 6, pp. 634–636, figs. 3*).—The low-growing yacca was controlled successfully on scrub land by F. J. Summers by cutting the leaves

off level with the ground with an adz and applying kerosene at the rate of about 150 plants per gallon. One man could treat from 240 to 300 yuccas per hour more effectively than by grubbing and at one-third the cost.

HORTICULTURE

[Horticultural studies at the Rhode Island Station] (*Rhode Island Sta. Rpt.* [*1930*], *pp. 33, 34, 35, 44–46*).—This continues earlier work (E. S. R., 63, p. 638).

Of seven varieties of yellow sweet corn Spanish Gold produced the largest number of ears, Whipple Yellow the largest and fewest ears, and Golden Gem the earliest crop.

Paper mulch as compared with the usual culture increased the yield and hastened the ripening of tomatoes, sweet corn, and peppers.

Nitrogen was found especially important for late beets, late spinach, late carrots, and early cabbage, phosphorous for tomatoes, and potash for late beets, late spinach, and late celery. With late celery a single application of fertilizer proved best, with early lettuce divided applications were best, and with cabbage, tomatoes, late beets, and spinach there was no appreciable difference between the two methods of application. Increasing the fertilizer application from 1,500 to 2,625 lbs. per acre profitably increased the yields of lettuce, celery, beets, tomatoes, and spinach, but not cabbage. Further increases did not produce added yields, and in several cases caused reductions.

The omission of potash caused outstanding reduction in the yield of the raspberry, whereas the omission of phosphorus or nitrogen had but little effect. Some indication was seen that potash favorably influenced the growth of the grape. Vinifera varieties differed widely in their adaptability, those grafted at the station on Concord, Clinton, and Beta being more vigorous than California-grown vines. Among blackberry seedlings obtained by crossing thorny and thornless types, two were found to be thornless.

[Horticulture at the Vermont Station] (*Vermont Sta. Bul. 319* (*1930*), *pp. 19, 22*).—Determinations of the pH of cherry fruits showed an average of 3.38 in Early Richmond varieties and 3.80 in Windsor types, with sugar contents (largely invert sugars) of 7.51 and 10.02, respectively. Many new apples, including Baxter, Blushed McIntosh, Cortland, Early McIntosh, Golden Delicious, Haralson, Hume, Ketosh, Lamfam, Lobo, Macoun, Melba, Milwaukee, Opalescent, Ranier, Red Gravenstein, Red Spy, Richared, Starking, Stonetosh, and Sweet McIntosh, were added to the variety trials.

Early Grano onion culture, F. Garcia and A. B. Fite (*New Mexico Sta. Bul. 193* (*1931*), *pp 15, figs 8*).—This is a brief report on a series of cultural tests of a promising new onion designated as the Early Grano. Grown under irrigation as transplanted seedlings, this variety matured as early as Crystal Wax and was on the whole more productive. In flavor the onion proved as sweet and mild as the late Valencia or the Crystal Wax. The largest yield was secured on well manured, fertile loam soil. Home-grown seed gave satisfactory results.

[Ripening tomatoes with ethylene gas on the farm], B. B. Powell and A. V. Krewatch (*C. R. E. A. News Letter* [*Chicago*], *No. 11* (*1931*), *pp. 43, 44*).—Operating and cost data are given on the ripening of tomatoes with ethylene gas. The results in general indicated that tomatoes when prevented from ripening by frost may be profitably ripened artificially on the farm.

A study of tree stocks in relation to winter injury and its prevention, L. Childs and G. G. Brown (*Oregon Sta. Circ. 103* (*1931*), *pp. 15, figs. 15*).—Wid

variation was noted in the character and extent of freezing injury in different varieties of apples and pears as grown in the Hood River Valley. As shown by trunk injury on the exposed side, Comice, Easter, and Flemish Beauty pears and the Astrachan, Arkansas, McIntosh, Ben Davis, and Delicious apples were apparently resistant to trunk injury, whereas the Anjou, Bosc, Bartlett, and Winter Nelis pears and the Newtown, Spitzenburg, Ortley, Jonathan, and Winter Banana apples were not resistant. Susceptible varieties protected from the winter sun were uninjured or only slightly injured. White water paint and board shields served as protecting agents. The nature of the rootstock was a factor, pear trees on Japanese roots being more subject to injury than were those on French roots. Many varieties of reputed hardiness are under trial for use as intermediate stocks for commercial varieties. Because of the association between winter injury and perennial canker, observations were made on the resistance to woolly aphis. Astrachan was found highly resistant, suggesting that this apple may have commercial value as an intermediate stock.

Grape culture, A. B. Fite and A. S. Curry (*New Mexico Sta. Bul. 192 (1931), pp. 29, figs. 14*).—Accompanied by certain data on yields of irrigated vines, a general discussion is presented on the culture of the grape, including such items as planting, irrigation, winter protection, training and pruning, varieties, control of pests, etc. Special information on grape culture at Fort Sumner is presented by S. E. Turner.

DISEASES OF PLANTS

Report on plant diseases [trans. title], Schander (*Jahresber. Preuss. Landw. Vers. u. Forschungsanst. Landsberg a. d. Warthe, 1928–29, pp. 52–84, figs. 5*).—This report on the activities of the institute for plant diseases and plant protection in the Provinces of Grenzmark and Brandenburg in Prussia on the right of the Oder, deals principally with cereals, potatoes, beets, fruit, and vegetables.

The genera Vermicularia Fr. and Colletotrichum Cda., M. M. Duke (*Brit. Mycol. Soc. Trans., 13 (1928), pt. 3–4, pp. 156–184, pl. 1, figs. 11*).—Investigation into the history of Vermicularia and Colletotrichum and examination of the structure of authentic specimens have led to the conclusion that no essential difference exists between these genera, and it is proposed to use the later name Colletotrichum for the inclusive genus. Species with few or no setae are regarded as transition species to Gloeosporium. Comparison with Volutella indicates that this is to be distinguished by its superficial origin, hyaline setae, and smallish oval spores.

Critical notes on cultural characters are contributed as applying to *C. dematium*, *C. eryngii*, *C. liliacearum*, *C. trichellum*, and *C. holci*. *C. lysimachiae* and *C. wahlenbergiae* are described as new species.

Some investigations of Aspergilli by serological methods, T. Matsumoto (*Phytopathology, 18 (1928), No. 1, p. 148*).—Methods employing successive intravenous inoculations of rabbits with *Aspergillus* spp. gave rather unsatisfactory results as regards agglutination experiments, but the reactions by means of complement fixation showed some significant relationships between the strains. The variations are wide, but generally less so between strains than between species. The complement fixation is thought to be more promising than precipitation tests for these particular fungi.

Ceratostomella paradoxa, the perfect stage of Thielaviopsis paradoxa (De Seynes) von Höhnel, H. A. Dade (*Brit. Mycol. Soc. Trans., 13 (1928), pt. 3–4, pp. 184–194, pls. 3*).—*T. paradoxa* is said to have been found in the Gold Coast in association with a form resembling Sphaeronema, the fruit body of

which is said to be a perithecium, bearing very characteristic appendages and producing very fugitive asci. The identity of the perithecial form with the conidial forms of *T. paradoxa* is said to have been proved by culture. Development of material from single ascospores shows the fungus to be heterothallic.

The fungus is considered as belonging to Ceratostomella, and the name *C. paradoxa* as appropriate.

Further observations on Corticium koleroga (Cke) v. Hohn, F. A. Wolf (*Phytopathology, 18 (1928), No. 1, pp. 147, 148*).—Collections in the Everglades, made after the publication of the paper previously noted (E. S. R., 61, p. 237), of *C. koleroga*, the fungus causing thread blight on citrus, pomaceous, and other hosts, lead to the view that this fungus is endemic in that section of Florida. Elsewhere it was found on coral tree (*Erythrina crista-galli*), the stunted branch growth suggesting that this fungus may have been present when the introduction from Brazil occurred. Near-by privet (*Ligustrum vulgare*) and a climbing rose were also affected, but not grapefruit and orange. In another locality, *Diospyros virginiana*, *D. kaki*, and *Ficus carica* were affected.

Supposedly, wind-blown basidiospores are unimportant in the spread of the fungus. Factors influencing the distribution are little known.

Heterothallism in the rust fungi, J. H. Craigie (*Phytopathology, 18 (1928), No. 1, p. 147*).—The author claims to have obtained conclusive evidence that *Puccinia graminis* and *P. helianthi* are heterothallic. The sporidia of two kinds (+ and —), are discussed.

The pycnium is to be regarded not as a spermagonium but as an active organ, which develops either (+) or (—) pycnospores and attracts flies by means of which the pycnospores of one sex are carried to the pycnia of another sex.

Two physiological forms of Ustilago striaeformis (Westd.) Niessl., W. H. Davis (*Phytopathology, 18 (1928), No. 1, p. 149*).—Though *U. striaeformis* has been reported as parasitic on 24 genera and 41 species of grasses, the problem of the physiologic specialization of this smut persists, and this investigation attempted to find whether physiologic forms occur in the smut on timothy (*Phleum pratense*) and on redtop (*Agrostis palustris*). Chlamydospores were found on both hosts at stations located in three States, and the seedlings employed in the inoculations were incubated from seeds collected at five widely distributed stations, according to procedures previously described (E. S. R., 56, p. 244).

It is concluded that there are two physiologic forms on the hosts named, *U. striaeformis* P. F. 1 or *U. phlei-pratensis* which infects timothy and not redtop, and *U. striaeformis* P. F. 2 or *U. agrostis-palustris* which infects redtop but not timothy.

Cytological studies of plant tissues affected with mosaic diseases, J. Dufrenoy (*Phytopathology, 18 (1928), No. 1, p. 154*).—Technical details are briefly stated.

Monochromatic light photography in the study of mosaic diseases, F. O. Holmes (*Phytopathology, 18 (1928), No. 1, p. 154*).—In over 600 representative monochromatic photographs taken of juices from plants affected with aster yellows, tobacco mosaic (strongly mottled) and ring spot, and potato rugose mosaic, aucuba mosaic, witches'-broom, and leaf roll, no formed elements other than those in normal plants were seen.

During a 3-year cytological study of Hippeastrum mosaic, neither included nucleus nor nuclear material was found. Photographs of the inclusions with monochromatic blue light showed a characteristic granular structure in the mass of the intracellular body, which was also observable in the living material.

Tropical root disease fungi, T. Petch (*Brit. Mycol. Soc. Trans., 13 (1928), pt. 3–4, pp. 238–253*).—These notes review the present position of the nomenclature of some of the fungi causing the principal root diseases of plantation crops in the eastern Tropics, including *Armillaria mellea* causing a root disease of *Acacia decurrens*, *Ustulina zonata* causing a root disease of tea, certain red root disease fungi of the East (*Poria hypolateritia*, chiefly on tea, and *P. hypobrunnea* on tea, but oftener on Hevea), and *Fomes lignosus* causing the principal root disease of *H. brasiliensis* in the eastern Tropics; also associated or related forms.

The fungicidal properties of certain spray-fluids, V, W. Goodwin, H. Martin, and E. S. Salmon (*Jour. Agr. Sci.* [*England*], *19 (1929), No. 3, pp. 405–412*).—The experiments described in this report were carried out along the same lines as those previously reported (E. S. R., 57, p. 638).

It was found that a solution of dicalcium hydrogen arsenate at 0.0125 per cent of As_2O_5 killed the conidial stage of *Sphaerotheca humuli*, but was not quite fungicidal at 0.006 per cent. Lime casein containing calcium hydroxide as a spreader reduced the effectiveness of the calcium arsenate spray.

Calcium thioarsenate at a strength corresponding to 0.006 per cent As_2O_5 was effective, but not at 0.003 per cent.

It is suggested that the increased fungicidal effectiveness of the mixed lime sulfur-lead acetate spray is due to calcium thioarsenates.

Factors affecting the fungicidal property of sulphur, H. C. Young and R. Williams (*Phytopathology, 18 (1928), No. 1, p. 147*).—This is said to be in part a continuation of an investigation previously reported (E. S. R., 58, p. 745.) The results show that pentathionic acid is the toxic factor in the use of sulfur.

When sulfur is mixed with such basic compounds as sodium hydrate, potassium hydrate, or calcium hydrate, the nontoxic salt of pentathionic acid is formed. However, as this salt forms, more acid is produced, and a general equilibrium is maintained. Sulfur freed of its pentathionic acid and placed in oxygen-free Van Tieghem cells was not toxic to the spores of *Sclerotinia cinerea*. Lime added to sulfur reduced the effectiveness against apple scab in the field.

An examination of fusaria in the herbarium of the pathological collections, Bureau of Plant Industry, U. S. Department of Agriculture, C. D. Sherbakoff (*Phytopathology, 18 (1928), No. 1, pp. 148, 149*).—An examination of 361 dry Fusarium specimens resulted in changes of many former determinations. The new species determined were *F. tumidum* on *Sarothamnus scoparius* and *Gibberella quinqueseptata* on *Cannabis sativa*, and the new combination determinations were *Fusicoccum fraxini* on *Fraxinus excelsior*, *Ramularia carniformis* on *Tripsacum dactyloides*, and *Rhabdospora oxydendri* on *Oxydendrum arboreum*.

Rye fusariose [trans. title], H. A. von Pfeil u. Klein-Ellguth (*Centbl. Bakt.* [*etc.*], *2. Abt., 73 (1928), No. 15–23, pp. 347–373, pl. 1, fig. 1*).—In Germany winter rye is attacked by several species of Fusarium, among these *F. herbarum*, *F. avenaceum*, *F. culmorum*, and *F. nivale*. The only treatment yet found effective is seed disinfection. Breeding of a rye immune to Fusarium, though theoretically possible, has not yet been accomplished.

Stripe rust in Alberta, G. B. Sanford and W. C. Broadfoot (*Sci. Agr., 9 (1929), No. 6, pp. 337–345, figs. 2*).—Stripe rust, *Puccinia glumarum*, is recorded for 1928 as on *Hordeum jubatum* from more than 70 places in Alberta, generally distributed south of the North Saskatchewan River. Three collections were made just north of the fifty-fifth parallel, one in Alberta and two in

British Columbia. Stripe rust was observed during 1928 in Alberta on *H. jubatum*, *H. vulgare*, *Triticum vulgare*, *T. durum*, *Agropyron smithii*, and *A. dasystachyum*.

A case is reported of overwintering of stripe rust in Alberta.

The wheat foot-rot disease in Kansas, L. E. MELCHERS (*Kans. Acad. Sci. Trans., 32 (1929), pp. 138–140*).—Wheat foot rot is thought to have been present in Kansas for at least 3 or 4 years previous to 1920, when specimens were sent from Dickinson County. After that year the disease became much more conspicuous. Evidence has been obtained that the causal organism may live on wild grasses.

Studies of foot-rot of wheat (take-all) in Kansas.—Second report of progress, L. E. MELCHERS and H. H. MCKINNEY (*Kans. Acad. Sci. Trans., 32 (1929), pp. 142, 143*).—Wheat foot rot or take-all is said to have been reported in 1921 as occurring in Dickinson, Saline, Riley, and Cheyenne Counties and in 1922 as in McPherson, Leavenworth, Jefferson, and Rice Counties, also as possibly present in Sedgwick and Morris, though in these two the presence of the causal organism was not definitely determined. Increases as to prevalence are reported. The disease produces much damage when it is common. Rotation is advised.

Wheat mosaic in Egypt, L. E. MELCHERS (*Science, 73 (1931), No. 1882, pp. 95, 96*).—A report is given of the presence of wheat mosaic in Egypt, where the author carried on investigations of wheat diseases from 1927 to 1929. The characteristics of the disease are briefly described. Rosette of wheat and barley was also observed. The reaction of the mosaic disease to certain American wheats led the author to consider that the viruses in Egypt and the United States are dissimilar.

Reactions of wheat varieties in the seedling stage to physiologic forms of Puccinia graminis tritici, M. NEWTON, T. JOHNSON, and A. M. BROWN (*Sci. Agr., 9 (1929), No. 10, pp. 656–661*).—The work of testing wheat varietal resistance to rust, reported on to 1927 (E. S. R., 58, p. 45) as having dealt with 23 common wheat varieties and crosses and 6 durum wheat varieties to 7 physiologic forms of *P. graminis tritici*, has been extended to include a number of other varieties and crosses. The rust reactions of most of these to 22 physiologic forms, including the 7 above mentioned, are here presented. The information is mainly tabular, dealing with a limited number of representative varieties arranged by groups, each grouping being characterized by something in common with respect to its rust reactions to the forms used.

It is stated that while not all of the physiologic forms of rust known in Canada were included, those used were sufficiently numerous and diverse to give a fairly accurate idea as to resistance or susceptibility; also those used are fairly representative, as they embrace all those which have occurred in appreciable amount within the last few years.

Frequency of natural crossing and its association with self-sterility in pure lines of Marquillo wheat, C. H. GOULDEN and K. W. NEATBY (*Sci. Agr., 9 (1929), No. 11, pp. 738–746, fig. 1*).—The experimentation here reported was initiated to obtain some measure of the extent to which a rust resistant might cross with a susceptible variety and hence deteriorate.

The procedure included the growing of pure lines of Marquillo, which is resistant to *Puccinia graminis tritici*, adjacent to the rows of the susceptible varieties of Huron and Preston, and covering heads of Marquillo in each line to prevent cross-pollination. Details and tabulations are given.

It is admitted that the importance of the high degree of natural crossing obtained in this experiment can not as yet be definitely interpreted. A note is added, including comment by H. K. Hayes.

Wheat loose smut control [trans. title], J. B. MARCHIONATTO (*Bol. Min. Agr. [Argentina], 28 (1929), No. 2, pp. 229–231*).—Hot air (75 to 85° C.), employed for periods of 30 to 90 minutes, proved efficacious for control of wheat loose smut (*Ustilago tritici*).

Take-all disease of wheat in Kansas, R. P. WHITE and L. E. MELCHERS (*Kans. Acad. Sci. Trans., 32 (1929), p. 141*).—*Ophiobolus* sp. has been isolated from fields showing wheat foot rot. Study applied to the association of other organisms with diseased wheat plants includes *Wojnowicia graminis* and *Helminthosporium* sp.

Comparative studies of Kabatiella caulivora (Kirchn.) Karak. and Colletotrichum trifolii Bain and Essary, two fungi which cause red clover anthracnose, K. SAMPSON (*Brit. Mycol. Soc. Trans., 13 (1928), pt. 1–2, pp. 103–142, pls. 3, figs. [7]*).—Dealing more particularly with two fungi, *K. caulivora* (*Gloeosporium caulivorum*) and *C. trifolii*, of those which have been recorded as causing red clover anthracnose diseases, the author gives results of character studies, including infection behavior.

The action of certain chemical substances on the zoospores of Pseudoperonospora humuli (Miy. et Takah.) Wils., W. GOODWIN, E. S. SALMON, and W. M. WARE (*Jour. Agr. Sci. [England], 19 (1929), No. 1, pp. 185–200*).—Beginning early in June, experimentation was carried out as to the suitability of various substances to combat hop downy mildew (*P. humuli*), some of the tests also applying to *Phytophthora infestans*.

It was found that in the zoospore stage both *Pseudoperonospora humuli* and *Phytophthora infestans* are extremely susceptible to the action of weak soap or saponin solutions. The zoospores disintegrate suddenly (within 60 seconds), supposedly due to changes in surface tension, in solutions higher than 0.1 per cent soft soap. Spores of *P. humuli* were more susceptible than those of *P. infestans*. The fungicidal action, as also the adhesiveness, of soap and saponin mixed with adherants was tested on hop plants.

Other substances, as aluminum-lime mixture, glycerin, iodine, and bromine, rapidly killed the zoopores.

Potato scab (*Vermont Sta. Bul. 319 (1930), p. 23*).—Confirmation was obtained of the presence of potato scab organism in soil kept in flasks for several years after inoculation. A comparison of methods employed in determining the loss of carbon dioxide from scabby tubers indicated that the methods hitherto utilized were accurate.

The occurrence of Aphanomyces cochlioides n. sp. on sugar beets in the United States, C. DRECHSLER (*Phytopathology, 18 (1928), No. 1, p. 149*).—Among isolations from sugar beet seedlings collected late in June, 1927, in fields near East Lansing and Saginaw, Mich., a fungus determined as the new species, *A. cochlioides*, presumably identical with the German form *A. laevis*, is said to have caused more injury than all other organisms together. Comparisons with other organisms are recorded.

Olpidium radicicolum de Wildeman and the "hybridisation nodules" of swedes, A. W. BARTLETT (*Brit. Mycol. Soc. Trans., 13 (1928), pt. 3–4, pp. 221–238, pls. 2*).—Besides the deformities caused on cruciferous plants by *Plasmodiophora brassicae* and a beetle (*Ceuthorhynchus sulcicollis*), some are found to which the name hybridization nodules is given and for which no parasitic organism has been found responsible. Two characters noted are the tendencies to become green by development of chlorophyll under exposure to light, and to produce blanched adventitious leafy shoots from underground parts of roots, which also turn green in sunlight. Outgrowths resembling

hybridization nodules have been noted on roots of swede, turnip, rape, kohlrabi, cabbage, cauliflower, and Brussels sprouts. The nodules are said to represent metamorphosed roots of the second and of the third order.

In the finer roots of numerous swedes and of a few cauliflowers bearing the hybridization nodules, but not in the nodules themselves, can be found *O. radicicolum;* in this both temporary and resting sporangia have been observed, as well as the escape of the zoospores from the former. Both the names *Asterocystis radicis* and *Olpidiaster radicis* are rejected in favor of *Olpidium radicicolum.*

This fungus is shown by pot experiments and under certain conditions to be very destructive to swede and turnip, and less so to cabbage seedlings.

The present account is believed to be the first given of the occurrence of *O. radicicolum* and *O. brassicae* in Great Britain.

Sweetpotato stem rot prevented by treating stems and roots with Bordeaux mixture, R. F. Poole (*Phytopathology, 18 (1928), No. 1, pp. 152, 153*).—As the outcome of contamination with *Fusarium batatatis* between pulling and resetting, many young sweetpotato plants are killed by the resulting stem rot. Inoculating plants with a pure culture produced much the same results under field conditions. Treatments designed to protect without causing injury were tested on the susceptible varieties Porto Rico and Yellow Jersey. The results differed for the various chemicals, but Bordeaux mixture 4–4–50 and stronger prevented field infections and greatly retarded the disease when present in pots.

Soil transmission of tomato mosaic and streak in the greenhouse, S. P. Doolittle (*Phytopathology, 18 (1928), No. 1, p. 155*).—The virus of tomato mosaic or of streak can remain active during at least 70 days in greenhouse soils, according to experimentation outlined. Preliminary studies indicate that the streak of tomato produced by a mixed infection with the tobacco mosaic virus and either mosaic or healthy potato juices is not identical with much of the streak which occurs in the field and greenhouse.

Further studies of the brown-rot fungi.—III, Nomenclature of the American brown-rot fungi: A review of literature and critical remarks, H. Wormald (*Brit. Mycol. Soc. Trans., 13 (1928), pt. 3–4, pp. 194–204*).—The brown rot fungus (E. S. R., 60, p. 551) generally distributed in the United States and Canada is considered to be more nearly related to *Sclerotinia cinerea* than to *S. fructigena,* which is claimed not to be known in North America. In the present state of knowledge, the author prefers the name *S. americana* for the more common brown rot fungus of America.

The fireblight situation in Ontario, D. H. Jones (*Sci. Agr., 9 (1929), No. 7, pp. 458–462*).—Considering the fact that bacterial blight of apple, pear, and quince was relatively scarce in 1928, the probable cause of this comparative freedom, and means to maintain this relatively favorable condition or to eradicate the disease completely, the author reviews briefly the practice and experience prevailing locally for some years past.

The recommended policy of cutting out fire blight infections has met with varied success, ranging from quick and apparently complete cleanness in orchards to a disadvantageous and dangerous prevalence in orchards more or less neglected. The pathogene does not overwinter in the soil, nor does it usually survive the winter in thin twigs, though it may live for weeks or months in the bark of blight cankered twigs that have been cut and left around, these furnishing a source for the fire blight in spring and early summer. It has recently been shown that most or all of the primary early spring infections may be due to rain washing and splashing the exudate from active cankers, from which insects may spread the secondary development.

It is thought that close scrutiny and radical cutting out and burning would practically eradicate the fire blight.

Paragynous antheridia of Phytophthora spp., D. COOPER (*Phytopathology, 18 (1928), No. 1, pp. 149, 150*).—Mycelium of *P. cactorum* enters unbroken epidermis of sound apples and pears by separating the lenticel cork cells. Zoospores in suspension also infect uninjured surfaces of fruit. The intercellular mycelium sends haustoria into the cells. Other relations and developments are described.

Fall applications of fungicides in relation to apple scab control, G. W. KEITT and E. E. WILSON (*Phytopathology, 18 (1928), No. 1, p. 146*).—In a continuation of studies previously reported (E. S. R., 59, p. 346), severely infected apple foliage was sprayed after harvest but before leaf fall with various materials, including calcium arsenite, Paris green, calcium silicofluoride, sodium silicofluoride, and certain proprietary preparations of chlorophenol mercury of different solubilities. Lime, Kayso, Bordeaux mixture, and other materials were added to these chemicals. Representative samples of untreated and treated leaves were overwintered and noted for the occurrence of perithecia of *Venturia inaequalis*, and numerous perithecia developed on the untreated leaves. Silicofluorides or chlorophenol mercury inhibited their development very slightly. Perithecial development was markedly reduced by calcium arsenite and Paris green, each in various combinations with other materials. Some treated leaves developed less than 10 per cent as many perithecia as the untreated. Calcium arsenite unmodified caused considerable host injury. While the results do not warrant specific recommendations for postharvest fungicidal applications for apple scab control, they offer promise of progress through attacking the fungus at a hitherto neglected, potentially vulnerable stage in its life history.

Certain sulphur fungicides in the control of apple scab, J. M. HAMILTON and G. W. KEITT (*Phytopathology, 18 (1928), No. 1, pp. 146, 147*).—Control of apple leaf infection by ascospores of *Venturia inaequalis* in the greenhouse under controlled conditions was sought in tests with lime sulfur (liquid), lime sulfur plus lead arsenate, aerated lime sulfur, sulfur-lead arsenate dust 90–10, and a commercial colloidal sulfur with and without lead arsenate, all these materials giving excellent control if applied 24 hours before inoculation, though considerable differences of result appeared when the fungicides were applied after inoculation. Lime sulphur 1–40 plus lead arsenate 1–50 controlled leaf infection when applied after an infection period of 45 hours at 7° C. (41.8° F.), or 30 hours at 24°. Sulfur-lead arsenate dust 90–10 was much less effective.

Lime sulfur 1–40 plus lead arsenate 1–50 applied to scabbed leaves in the orchard prevented spore germination and sharply inhibited spore production from the treated lesions during 9 weeks, regardless of rains. Sulfur-lead arsenate dust 90–10 gave like results until the first heavy rain, which was followed by viable spores.

Lime sulfur and sulfur dust on small parts of the upper side of apple leaves protected the entire upper surface from infection by naturally discharged ascospores.

Studies upon the Fusarium wilt of China aster, L. R. JONES and R. S. RIKER (*Phytopathology, 18 (1928), No. 1, p. 150*).—Though *F. conglutinans callistephi* is scarcely distinguishable from the fungus causing cabbage yellows and temperature relations are very similar, reciprocal crosses showed each to be specific. Data for each are given. Considerable difference as to disease occurrence has been noted as between varieties and among individuals, and selection studies have been conducted for three seasons with promising results.

Bulb growing in Holland and its relation to disease control, F. L. Drayton (*Sci. Agr., 9 (1929), No. 8, pp. 494–509, figs. 8*).—An account is given of routine management and variations in treatment designed to prevent or remedy soil-borne diseases of bulbs locally grown, including both general cultural methods and those specifically applicable.

Diseases of hyacinth which can be detected by trained searchers include the yellow disease (*Pseudomonas hyacinthi*), the old or ring disease (*Tylenchus dipsaci*), the so-called Zwart snot or black slime (*Sclerotinia bulborum*), and a leaf-destroying disease or fire caused by *Botrytis hyacinthi*. The most important of these for the time being is yellow disease.

Narcissus is subject to a ring or nematode disease (*T. dipsaci*) and a root rot supposedly due to an undetermined fungus. One or more species of Fusaria may factor in a basal decay affecting 6 or 8 varieties.

Tulip is subject to the same nematode as is narcissus and to as highly injurious a degree. Also, outbreaks have occurred of disease caused by *Rhizoctonia* (*Sclerotium*) *tuliparum* and of the fire disease caused by *B. tulipae*. Of recent years, cases of the so-called new disease caused by an undescribed sclerotium-producing fungus have been observed.

Gladiolus diseases as named in the alleged order of importance include the hard rot (*Septoria gladioli*), the dry rot (*Sclerotium gladioli*), the scab or neck rot (*Bacterium marginatum*), and a neck and corm disease caused by an undescribed fungus of the Botrytis type.

Recommendations for the eradication of these diseases are detailed.

Progress report on the condition of bulbs and corms of ornamental plants offered for importation into Canada, F. L. Drayton (*Phytopathology, 18 (1928), No. 1, pp. 150, 151*).—Investigations of unsatisfactory conditions in shipments of foreign origin of nursery stocks of ornamentals, including bulbs, showed injuries which were classified according to microscopic characters and cultured, yielding among the known pathogenes *Bacterium marginatum*, *B. hyacinthi*, *Septoria gladioli*, *Botrytis tulipae*, *Rhizoctonia tuliparum*, *Sclerotium* sp., *Tylenchus dipsaci*, and a number of species of Fusarium and sclerotia-producing fungi. Insect injury and improper handling, curing, etc., also encouraged the development of saprophytic fungi, mites, etc., and thus contributed in general to the considerable tendency toward breakdown.

Penicillium corm rot of gladioli, O. H. Elmer (*Phytopathology, 18 (1928), No. 1, p. 151*).—A descriptive account is given of a hitherto undescribed storage rot of gladiolus corms of many varieties frequently occurring in Iowa during the previous two years. Laboratory studies have shown the cause to be *P. gladioli*. This was previously described as a new species and further described by McCulloch and Thom (E. S. R., 59, p. 246). Infection of corms in storage occurred through wounds only. No infection occurred on corms of growing plants.

Observations concerning diseases of iris and tulips, E. B. Mains (*Ind. Acad. Sci. Proc., 44 (1928), pp. 93–102, fig. 11*).—Iris diseases, as here dealt with, include soft rot (*Bacillus carotovorus*), sclerotial rot (*Sclerotium rolfsii* ?), leaf spot (*Didymellina iridis*, *Heterosporium gracile*), and rust (*Puccinia iridis*). Tulip disease includes only Botrytis blight or fire disease (*Botrytis tulipae*).

On an extraordinary Botrytis causing a disease of narcissus leaves, W. J. Dowson (*Brit. Mycol. Soc. Trans., 13 (1928), pt. 1–2, pp. 95–102, pl. 1, figs. 3*).—Record is made of the occurrence and appearance of a narcissus leaf yellow blotch disease in southwest England and north Ireland, which is called by growers "fire."

. fungus isolated from the blotches, grown in pure culture and tested by ıns of infection experiments, appears pathogenic to leaves only. The organ- is described as the new species *B. polyblastis*, with description of the very ;e conidia, the microconidia, and the sclerotia. The presence of an unusually ;e number of germ tubes is described.

tudies on snapdragon rust, Puccinia antirrhini, E. B. MAINS and D. ›MPSON (*Phytopathology, 18* (*1928*), *No. 1, p. 150*).—Urediniospores of *P. ırrhini* germinate through a temperature range of from 0+ to 26+° C. and ›ugh a pH range of from 3.6 to 8.0, with the optimum from pH 6.0 to 6.2. per dust reduced germination somewhat, slaked lime considerably. Sulfur the most effective germicide. The effect of temperature on infection ›ed with the results as regards spore germination. Dusting with sulfur ost completely controlled the infection even when undusted plants died early. ›ctions for resistance during four years have developed several lines show- marked resistance, the host cells often dying before sporulation occurred.

[ottle-leaf disease of beech, W. H. RANKIN (*Phytopathology, 18* (*1928*), *1, pp. 151, 152*).—A considerable part of the beech trees near Philadelphia, have shown for several years a leaf mottling, which is described and ch has not yet been correlated with any definite agent or condition. It ›ars on development of the leaves in the spring. Tests were made with ›ypically affected trees employing the injection in solutions of from 51 to gm. of magnesium nitrate and from 10 to 47 gm. of ferrous sulfate. No ked improvement appeared during the summer.

utch elm disease in Ohio, C. MAY (*Science, 72* (*1930*), *No. 1858, pp. 142,* .—The author reports several cases of the Dutch elm disease in Ohio. m the original specimens of diseased twigs *Graphium ulmi* was isolated. ked evidence of parasitism of the fungus was observed.

homopsis conorum (Sacc.) Died.: An old fungus of the Douglas fir other conifers, G. G. HAHN (*Brit. Mycol. Soc. Trans., 13* (*1928*), *pt. 3–4,* *278–286, pls. 2*).—Record is made for the first time of *P. conorum* on shoots ›ouglas fir in Great Britain. As this is easily confused with *P. pseudotsugae,* on Douglas fir, a full description is given of *P. conorum* based on fresh erial carried on Douglas fir from Scotland. Fresh collections of this fungus reported also from Wales, England, Holland, and Denmark. Other hosts of organism include Pinus, Picea, and Abies.

oth morphological and physiological differences exist between *P. conorum* *P. pseudotsugae,* and these differences are distinct in culture.

arch canker [trans. title], E. v. GAISBERG (*Centbl. Bakt.* [*etc.*], *2. Abt., 73* *!8*), *No. 8–14, pp. 206–233*).—A study is detailed of larch canker (*Dasy- ›ha willkommii*), particularly as regards spore germination and influencing litions.

urrant rust control, J. F. HOCKEY (*Sci. Agr., 9* (*1929*), *No. 7, pp. 455–* .—The present account is presented for the furtherance of control of ›ant rust due to *Cronartium ribicola.*

n the basis of 3 years' observations, it is claimed that defoliation of black ants by *C. ribicola* can be prevented by four applications of sulfur dust to undersurface, or the place of that fungicide can be taken by lime-sulfur y of 1.008 sp. gr., used before blooming. Under local conditions Boskoop ore resistant than is Black Victoria or Saunders which, with rust controlled, ›ields Black Victoria.

lack walnut canker, C. R. ORTON (*Science, 72* (*1930*), *No. 1858, p. 142*).— author describes a canker disease of black walnut that was observed in [illegible]

diameter from 3 to 20 in. The cankers were located at any point on the older wood, but were most conspicuous upon the trunk and larger limbs, where they form "cat-faces" or targets composed of prominent concentric rings of callus tissue. On the cankers a species of Nectria was found that suggests a near relationship with the canker of beech and other deciduous trees in Europe, and which occurs on the apple in America. No records were found of this fungus occurring on the black walnut.

The Physalospora disease of the basket willow, R. M. NATTRASS (*Brit. Mycol. Soc. Trans., 13 (1928), pt. 3–4, pp. 286–304, pls. 4*).—Regarding the so-called Physalospora disease of basket willow in the Somerset willow-growing district of England, the present paper records the results of study dealing with symptoms, isolation, and comparison of the associated organism, its cultural characters, systematic position, appropriate name, inoculation experiments testing pathogenicity, and control measures. The fungus is provisionally regarded as not essentially different from *P. miyabeana*, but the question of its having a closer relation to the genus Glomerella remains to be settled by further work.

Further attention to this work, as noted in an addendum, shows that while *P. miyabeana* is invariably present in the diseased tissue, *Fusicladium saliciperdum* occurs seldom and never at the margin. A briefer account appears below.

"Black canker" of the basket willow, R. M. NATTRASS and H. P. HUTCHINSON (*Jour. Min. Agr. [Gt. Brit.], 36 (1929), No. 4, pp. 363–369, pls. 2*).—This account, picturing the disease with description and indicating varietal susceptibility and control measures, states that the investigations that have been carried out show *Physalospora miyabeana* to be a virulent primary parasite, capable of attacking the willow crop in all stages of its growth.

No spray fluid in common use is likely to show any direct contact fungicidal effect on either the winter or the summer fruiting bodies. The crop becomes normally infected through the leaves and the end tips of the rods and the protection of these against the fungus is suggested. It has been found that the spores are killed if they germinate in contact with a toxic film on the leaf surface which can be produced by spraying the plants with a copper fungicide, as Bordeaux mixture. This has the advantage of persisting through the greater part of the growing season. Field experiments by the authors have shown that freshly prepared Bordeaux mixture will not only control black canker to a considerable degree, but that attacks of rust (*Melampsora* sp.) are prevented. The first application should be made early and thoroughly and should be repeated at intervals of 3 or 4 weeks, according to weather conditions, as long as practicable.

Owing to the nature of the willow crop, complete control can not be obtained by spraying under field conditions, but the effect from season to season is likely to be cumulative. Further preventive measures require the adoption of a system of plantation hygiene, paying particular regard to several points, including close cutting of the rods, burning as much as possible of the affected material, and the planting only of clean, healthy sets.

ECONOMIC ZOOLOGY—ENTOMOLOGY

Second Bulletin of the International Committee for Bird Preservation, compiled by T. G. PEARSON (*New York: Internatl. Com. Bird Preserv., 1929, pp. [3]+51, fig. 1*).—This bulletin reports particularly upon the conference held at Geneva in 1928 (E. S. R., 57, p. 552).

The bobwhite quail—its habits, preservation, and increase, H. L. STODDARD (*New York: Charles Scribner's Sons, 1931, pp. XXIX+559, pls. 69, figs.

32).—This monographic account of *Colinus virginianus* and its races is based upon work sponsored by the Committee on the Cooperative Quail Investigation, of which L. S. Thompson is chairman and A. B. Lapsley secretary, in cooperation with the U. S. D. A. Bureau of Biological Survey, and carried on by the author, assisted by C. O. Handley, in southern Georgia and northern Florida from March 17, 1924, to June 30, 1929 (E. S. R., 58, p. 855). The account is presented under chapter headings substantially as follows: Types of southeastern quail territory (pp. 3–13); life history of the bobwhite (pp. 15–47); miscellaneous habits (pp. 49–67); development, plumage, and sex ratio (pp. 69–95); bobwhite's vocabulary (pp. 97–111); food and feeding habits, by Handley and C. Cottam (pp. 113–165); movements as determined by banding studies (pp. 167–182); mortality (pp. 183–227); internal parasites and parasitic diseases, by E. B. Cram, M. F. Jones, and E. A. Allen (pp. 229–313); external parasites (pp. 315–323); nonparasitic diseases (pp. 325–338); quail populations and their fluctuations (pp. 339–347); the relation of agricultural activities to the bobwhite (pp. 349–358); quail preserve development and management, by Stoddard and Handley (pp. 359–400); the use and abuse of fire on southern quail preserves (pp. 401–414); control of natural enemies of the bobwhite (pp. 415–437); methods of capturing bobwhites (pp. 439–450); artificial propagation, by W. B. Coleman and Stoddard (pp. 451–478); use of Texas bobwhites, or "Mexican" quail, in restocking (pp. 479–489); and some popular beliefs and attitudes in regard to bobwhites (pp. 491–505).

An appendix consisting of 18 tables is included (pp. 507–543).

A biological reconnaissance of the Peterboro Swamp and the Labrador Pond areas, C. J. Spiker (*Roosevelt Wild Life Bul.* [*Syracuse Univ.*], *6* (*1931*), *No. 1, pp. 152, pls.* [*2*], *figs.* [77]).—Part 1 (pp. 12–100) of this report includes a list of 114 birds in the Peterboro region with a list of 48 references to the literature, and part 2 (pp. 101–151) a list of 107 birds in the Labrador Pond region.

The birds of Haiti and the Dominican Republic, A. Wetmore and B. H. Swales (*U. S. Natl. Mus. Bul. 155* (*1931*), *pp. IV+483, pls. 26, figs. 2*).—Following an introductory part in which the physiography, history of ornithological investigations, discussion of the avifauna, recommendations regarding further studies, and method of treatment are considered, the birds of Haiti and the Dominican Republic are taken up, the arrangement being by families. A bibliography of 12 pages is included.

The birds of the Philippine Islands, with notes on the mammal fauna, Part I, M. Hachisuka (*London: H. F. & G. Witherby, 1931, pt. 1, pp. 168, pls. 26, figs. 2*).—This first part of the author's work deals with the geography and climate (pp. 5–14), ornithological history (pp. 15–52), a short account of the author's journey to the Philippines (pp. 53–95), a bibliography arranged chronologically for the years 1831 to 1930, inclusive (pp. 96–149), and the beginning of a systematic account (pp. 150–168).

Birds of Denmark, III, E. L. Schiøler (*Danmarks Fugle. Copenhagen: Gyldendalske Boghandel, 1931, vol. 3, pp. 413, pls. 92, figs. 35*).—This third volume of the work previously noted (E. S. R., 57, p. 754), which is illustrated largely with colored plates, deals with the order Falconiformes.

A textbook of agricultural entomology, K. M. Smith (*Cambridge: Univ. Press, 1931, pp. XIII+285, pl. 1, figs. 79*).—Following chapters on the organization of agricultural entomology in England and Wales, methods of insect control and their application in farming practice, and the effect of weather conditions on insect outbreaks, the subject is taken up under the various order headings and concludes with a chapter on insects and virus diseases of crops. There are two appendixes, the first consisting of a list of characteristic symp-

toms of insect attack on agricultural crops together with the insect responsibl and the second a list of common farm weeds and the insect pests associate with them.

[Eighth biennial report of the Montana State Board of Entomology, 1929–1930] (*Mont. State Bd. Ent. Bien. Rpt., 8 (1929–30), pp. 44, figs. 4*).—This report (E. S. R., 61, p. 656) includes a summary of the activities for 1929–30 (pp. 7, 8), the cooperation with the United States Public Health Service (pp. 9, 10), organization and personnel (p. 11), and Rocky Mountain spotted fever outside of Montana (pp. 12–15), and the following papers: Review of Tick Parasite Work for 1929 and 1930, by R. A. Cooley (pp. 16–25); A Summary of Parasite Liberations, by G. M. Kohls (pp. 26–35); Present Status of the Use of Public Health Vaccine for Rocky Mountain Spotted Fever, by R. R. Parker (pp. 36–38); Review of Dipping and Quarantines, by W. J. Butler (pp. 38–40); and Control Work: Rocky Mountain Spotted Fever Control Districts, Bitter Root Valley, for the Biennium Ending December 31, 1930, by F. J. O'Donnell (pp. 40–44).

[Contributions on economic insects in Italy and its dependencies] (*Redia, 18 (1930), pp. [1]+407, pls. 6, figs. 21*).—The contributions presented are as follows: A Contribution to the Knowledge of the Insects Injurious to Agricultural and Forest Plants of Sardinia, by A. Melis (pp. 1–120); A Variety of Aspidiotus, *Aspidiotus hederae* var. *unipectinata* Car., by M. Carimini (pp. 121–123); Contributions to the Knowledge of the Anatomy of the Stigmata of Insects (Stigmata of the Larvae of Lepidoptera and Coleoptera), by A. Melis (pp. 125–162); Color Variation in the Larvae of *Mamestra brassicae*, by M. Carimini (pp. 163–169); Investigations and Experiments with the Olive Fly in Apulia from 1910 to 1914, and in Other Regions of Italy from 1915 to 1928, by G. del Guercio (pp. 171–399); and Five Years' Work in Combating the Olive Fly in Sardinia, by A. Melis (pp. 401–407).

[Contributions on economic insects in China] (*Lingnan Sci. Jour., 7 (1929), pp. 401–823, figs. 173*).—The contributions relating to insects of economic importance are as follows: Collection of Mosquitoes in South China, by H. L. Chung and Y. Y. Lin (pp. 401–407); On Two Species of Sphaeridium from the Oriental Region (Coleoptera, Hydrophilidae), by A. D'Orchymont (pp. 409–412); Gall Midges or Gall Gnats of the Orient (Itonididae or Cecidomyiidae), by E. P. Felt (pp. 413–474); The Membracidae of China, by W. D. Funkhouser (pp. 475–481); A Common Moth [*Euzora* sp.?] and Some of Its Enemies, by N. G. Gee (pp. 483–490); The Brenthidae and Lycidae of China, by R. Kleine (pp. 491–496); Our Present Knowledge about the Pupipara and Tabanidae of China, by J. H. Schuurmans Stekhoven, jr. (pp. 497–510); A New Species of Stonefly [*Nemoura pekinensis*] from China (Order Plecoptera, Family Nemouridae), by P. W. Claassen (pp. 511–513); Biological Notes on a Chrysomelid Pest of Bamboo, by H. T. Chen (pp. 515–529); Termites, Destroyers of Wood, and Man's Fight against Them, by T. E. Snyder (pp. 531–579); Present Status of Our Knowledge of the Termites of China, by S. F. Light (pp. 581–600); Insect Inhabitants of the Fruiting Sprays of the Pagoda Tree, *Sophora japonica*, by J. G. Needham (pp. 601–611); Studies on the Chinese Honey-bee (*Apis indica* F., var. *peroni*), by C. R. Kellogg (pp. 613–623); Some Principles Useful in Solving Economic Biological Problems, by W. D. Pierce (pp. 625–631); A Study of *Brachyplatus subaëneus* Westw.), by R. E. Wall (pp. 633–649); The Nervous System of the White Grub (the Larva of *Osmoderma socialis* Horn)—Part 1, External Characters of the Nervous System (pp. 651–665, Part 2, Internal Structure of the Brain and Ventral Nerve Cord (pp. 667–695), by C. F. Wu; External Morphology of the Corn Ear Worm,

by L. Shu-Yen (pp. 697–713); The Present Status of Knowledge about Chinese Gyrinidae, by G. Ochs (pp. 715–720); On the Cricket-Locusts (Gryllacrids) of China, by H. H. Karny (pp. 721–757); A List of the Coprophagous Coleoptera of China, by A. Boucomont (pp. 759–794); Notes on the Life History of a Wild Silk Worm, by K. S. Chan (pp. 795–815); and the Life History of *Rhynchocoris humeralis* Thunb. (Hemiptera, Pentatomidae), by W. E. Hoffmann (pp. 817–823).

List of publications on Indian entomology, 1929 (*Imp. Inst. Agr. Research, Pusa, Bul. 207 (1931), pp.* [2]+*36*).—This list is in continuation of those of previous years (E. S. R., 62, p. 582).

Report of the entomologist, A. H. RITCHIE (*Tanganyika Ter. Dept. Agr. Ann. Rpt. 1929–30, pt. 2, pp. 37–44*).—Brief accounts are given of the work with the more important insects of the year (E. S. R., 63, p. 846).

Entomological investigations, G. A. JULIUS ET AL. (*Aust. Council Sci. and Indus. Research Ann. Rpt., 4 (1929–30), pp. 26–28*).—A brief account is given of entomological work conducted from the headquarters at Camberra.

A preliminary record of some of the more important parasites of sugar cane insects in Negros, W. D. PIERCE (*Sugar News, 11 (1930), No. 12, pp. 735, 736*).—This is a brief account of the more important insect enemies of sugarcane in Negros, on which the author has reported (E. S. R., 64, pp. 242, 456).

Two important pests of the clove tree, N. C. E. MILLER (*Malayan Agr. Jour., 19 (1931), No. 1, pp. 9–13, pls. 2*).—This contribution deals with the cerambycid *Chelidonium brevicorne* Schwarzer and the moth borer *Paralecta antistola* Meyr., which are responsible for a considerable reduction in the clover crop of Penang Island and Province Wellesley.

The symbiotes of some important lac insects, S. MAHDIHASSAN (*Arch. Protistenk., 73 (1931), No. 2, pp. 164–178, figs. 13*).—This account includes a list of 10 references to the literature.

Biological control of prickly-pear, F. D. POWER ET AL. (*Queensland Prickly-Pear Land Comn. Ann. Rpt., 5 (1928–29), pp. 16–19, pls. 3*).—This is a progress report of control work, particularly with insects, including *Cactoblastis cactorum.*

Devil's shoe-string as an insecticide, V. A. LITTLE (*Science, 73 (1931), No. 1890, pp. 315, 316*).—In work with the cotton aphid, devil's-shoestrings (*Cracca virginiana*) was found slightly more toxic than pyrethrum but less toxic than Derris.

Neonicotine and isomeric pyridylpiperidines, C. R. SMITH (*Jour. Amer. Chem. Soc., 53 (1931), No. 1, pp. 277–283*).—The author found that neonicotine (β-pyridyl-α-piperidine) was separated from the products obtained in the sodium-pyridine-oxygen reaction. It is considered probable that the nicotimine isolated by A. Pictet and A. Rotschy[3] from the nicotine alkaloids and tentatively identified by them as the same product is different.

Pyrethrum as an insecticide and its cultivation in England, J. C. F. FRYER and C. T. GIMINGHAM (*Nature [London], 127 (1931), No. 3206, pp. 573, 574*).—Reference is made to the experimental cultivation of pyrethrum in England, where work was started in 1925 on small plats laid down at some 16 centers on a variety of types of soil, and to tests made of the insecticidal value.

The toxicity of rotenone, isorotenone, and dihydrorotenone to goldfish, W. A. GERSDORFF (*Jour. Amer. Chem. Soc., 52 (1930), No. 12, pp. 5051–5056, figs. 3*).—It is reported from the Insecticide Division, U. S. D. A. Bureau of Chemistry and Soils, that "the toxicity of rotenone begins at a higher concentration than that of dihydrorotenone (about twice, according to Powers' formula) and

[3] Ber. Deut. Chem. Gesell., 34 (1901), pp. 696–708.

a lower concentration than that of isorotenone (about one-fourth). The toxicities of rotenone and dihydrorotenone increase with increase in concentration at about the same rate, but this rate is lower in the case of isorotenone (about one-third). At higher concentrations, rotenone is the most toxic and isorotenone the least. According to Powers' formula, which is an expression of relative toxicity based on the first two variables, these substances have the following decreasing order of toxicity—dihydrorotenone, rotenone, and isorotenone."

Life history of Protostrongylus (Synthetocaulus) rufescens, A. and M. Hobmaier (*Soc. Expt. Biol. and Med. Proc., 28 (1930), No. 2, pp. 156–158, figs. 2*).—In experiments conducted, the intermediate hosts of *S.* (*Mullerius*) *capillaris* failed to yield larvae of *P. rufescens* when fed embryos of this lungworm. Larvae were secured, however, when the experiments were conducted with the genus Helicella. The fact that the intermediate hosts of *S. capillaris* are snails which prefer a shaded or half-shaded environment, while those of *P. rufescens* belong to the dry geophilus snails, is considered of particular interest.

"The embryos enter the snail by way of the mucous glands of the foot. Histologic sections of the foot reveal the mode of penetration of the embryos and the transformation into larvae. A small tubereclelike proliferation is formed around the worm as an expression of a reaction to the invasion. The development of the embryo into the larva is quite similar to that of *M. capillaris*. It is completed 12 to 14 days after infection of the snails. Many changes in shape and size of the parasite characterize the two moltings. The cuticula appears separated but it is not shed. The twice-molted embryo represents the infective larva." Its development in mammals is the same as that of other lungworms.

A note on termites, H. M. Pendlebury (*Malayan Forest Rec., No. 8 (1930), pp. 45–56, pls. 6.*)—This account of termites includes a list of the species commonly met with in the Federated Malay States.

A new louse from domestic chickens (Mallophaga: Philopteridae), H. S. Peters (*Ent. News, 42 (1931), No. 7, pp. 195–199, figs. 2*).—Under the name *Lipeurus tropicalis* n. sp. the author describes a biting louse taken from the heads of chickens in four localities in the southern Bahama Islands in 1930.

Yellow-spot disease of pineapples transmitted by Thrips tabaci Lind., M. B. Linford (*Science, 73 (1931), No. 1888, p. 263*).—The author reports that he has obtained experimental evidence that the onion thrips is a major vector operating in the field occurrence of a destructive disease of pineapple plants in the Hawaiian Islands known as yellow spot disease. This thrips carries the virus to pineapple from certain weeds, of which *Emilia flammea* now appears most important.

Aphidid galls: Histogenetic and biological studies of the Tetraneura and Schizoneura galls. The aphidid galls as an aid to gall research [trans. title], F. Zweigelt (*Monog. Angew. Ent. No. 11 (1931), pp. XXI+684, pls. 5, figs. 155*).—The several chapters of the first or special part of the work (pp. 1–448) deal with the phenology, morphology, and biology of aphidid galls of the elm and their occupants; a report of experimental work conducted in 1919 and 1920; the normal comparative anatomy of the organs of assimilation of *Ulmus montana* in its three forms (*U. montana major dampieri wedrei*, *U. montana major atropurpurea*, and *U. montana pendula*); anatomy of the galls of *T. ulmi;* anatomy and histogenesis of the *S. ulmi* galls; abnormal galls; and the phylogeny of plant anatomy and gall histology. The chapters of the second or general part (pp. 449–661) consist of discussions of the galls of aphids and their formation, of their adaptation, and of their importance to

the insect and the host plant. The subject is considered in connection with references to the literature, a list of 479 of which is included.

The red scale problem, H. J. QUAYLE (*Calif. Citrogr., 16 (1931), No. 5, pp. 192, 259*).—This discussion of the red scale problem is contributed from the California Citrus Experiment Station.

Investigations on the control of the red scale, R. H. SMITH (*Calif. Citrogr., 16 (1931), No. 7, pp. 310, 344, 345, fig. 1*).—A practical summary of information on control investigations of the red scale, contributed from the California Citrus Experiment Station. The study has included investigations of oil sprays, soap sprays, sulfur compounds and other metallic poisons, dusts, absorbed substances in trees, vapors and gases other than those used in ordinary fumigation, heat, and radiations.

An imported parasite attacks the yellow scale, H. S. SMITH and H. COMPERE (*Calif. Citrogr., 16 (1931), No. 7, p. 328, figs. 2*).—The authors report that *Comperiella bifasciata* How., successfully established at the California Citrus Experiment Station from colonies imported from the Orient in 1924, may prove to be of value on the yellow scale in California. With this in view the station is now undertaking the propagation and colonization of this parasite in orchards where the yellow scale occurs.

The natural enemies of Lecanium corni L. [trans. title], H. and P. VOUKASSOVITCH (*Compt. Rend. Soc. Biol. [Paris], 106 (1931), No. 8, pp. 688–691*).—An account is given of observations made of the natural enemies of the European fruit lecanium met with in the prune orchards of Yugoslavia, which, in addition to the predators, particularly the coleopteran *Exochomus quadripustulatus*, studies of which are noted, include the chalcid parasites *Caccophagus scutellaris* Dalm, *Eucomys swederi* Dalm, *Cerapiocerus mirabilis* Westw., and *Blastothrix sericea* Dalm. In general, the natural control by these enemies has been weak, only *E. quadripustulatus* and *C. scutellaris* having been at all effective. The decline observed in the intensity of its infestation can not be attributed to the action of parasites.

On the mortality of Lecanium corni L. [trans. title], H. and P. VOUKASSOVITCH (*Compt. Rend. Soc. Biol. [Paris], 106 (1931), No. 8, pp. 691–694*).—This contribution, which supplements that above noted, records a high mortality of the European fruit lecanium (*L. corni*) at different periods in its development, the causes for which have been difficult to determine. Observations of its parasites, made with the view to determining the percentage of mortality caused, are reported.

The squash vine borer (Melittia satyriniformis Hübner), R. B. FRIEND (*Connecticut State Sta. Bul. 328 (1931), pp. 583–608, figs. 3*).—From studies of the squash borer, control experiments with which were conducted at New Haven, it is concluded that none of the cultural control measures advocated give as much promise as a spraying schedule. Under Connecticut conditions it is recommended that winter squash vines be sprayed at weekly intervals four times during July, beginning about July 5. Only the basal 4 ft. of the vines need to be sprayed, and care should be taken to cover thoroughly the under side of the stem of the vine as well as the upper side, the leaf stalks, and the under side of the leaves. Lead arsenate and fish oil, coated lead arsenate, or nicotine sulfate should give good results. The lead arsenate and fish oil should be used at the rate of 3 lbs. of lead arsenate plus 1 qt. of fish oil in 100 gal. of water, and coated lead arsenate should be used at the rate of 8 lbs. to 100 gal. of water. If a hand spraying apparatus is used nicotine sulfate should be diluted 1 to 100, but if a power sprayer is used it should be diluted 1 to 250. In regard to the cost of spray materials, lead arsenate plus fish oil

is the cheapest of the three. The increase in crop yield obtained by spraying will more than offset the cost of spraying, even when the most expensive of these materials is used.

A lepidopterous enemy of red and black currants in north Sweden (Incurvaria trimaculella quadrimaculella Höfn.) [trans. title], O. Lundblad (*Medde*. *Centralanst. Försöksv. Jordbruksområdet* [*Sweden*], *No. 374* (*1930*), *pp. 25, figs. 13, Ger. abs. pp. 23, 24; abs. in Rev. Appl. Ent., 18* (*1930*), *Ser. A, No. 12, pp. 694, 695*).—This is a summary of information on a small lepidopteran found in the Province of Jämtland which attacks the leaves of currants, presented in connection with a list of 21 references to the literature.

Microbes virulent for the caterpillars of Galleria mellonella and Pyrausta nubilalis [trans. title], V. Zernoff (*Compt. Rend. Soc. Biol.* [*Paris*], *106* (*1931*), *No. 7, pp. 543–546*).—Two strains of extraordinary virulence were found among the microbes isolated by Métalnikov (E. S. R., 58, p. 758) from diseased caterpillars, namely, *Coccobacillus ellingeri* isolated from European corn borer larvae and a bacillus of the type *Bacillus prodigiosus* isolated from Lymantria caterpillars in Yugoslavia in the spring of 1930.

Malaria transmission in the Philippines.—I, The natural vector, C. Manalang (*Philippine Jour. Sci., 45* (*1931*), *No. 2, pp. 241–249, pl. 1, fig. 1*).—Two years of dissection of anophelines caught in 10 localities are said to show conclusively that of the 12 species numerically well represented in about 65,000 mosquitoes, *Anopheles funestus* (*minimus*), the same vector found in 1927 (E. S. R., 60, p. 652), is the natural vector of malaria in the Philippines.

***The possible transfer of dengue virus from infected to normal mosquitoes* during copulation,** J. S. Simmons, J. H. St. John, R. L. Holt, and F. H. K. Reynolds (*Amer. Jour. Trop. Med., 11* (*1931*), *No. 3, pp. 199–216, figs. 8*).—The authors conclude that the evidence presented in five separate experimental attempts to effect a transfer of virus from mosquito to mosquito by copulation either directly or after maturation of the virus in the males strongly suggests that if it is possible at all, as one experiment would seem to indicate, it is effected with great difficulty, and that if it does occur in nature it probably occurs but rarely. The possible transfer of dengue virus from mosquito to mosquito by copulation may, therefore, be regarded as an unimportant and improbable means of perpetuating the virus of dengue in mosquitoes.

***On the transmission of dengue in Sumatra*,** E. P. Snijders, E. J. Dinger, and W. A. P. Schüffner (*Amer. Jour. Trop. Med., 11* (*1931*), *No. 3, pp. 171–197, figs. 20*).—The authors find that it is possible to dispatch Aedes mosquitoes infected with dengue virus long distances, as from Sumatra to Amsterdam, without destroying their infectivity. It has been proved possible to cause typical cases of dengue in the Netherlands through bites from mosquitoes infected in the Dutch East Indies (Sumatra). The endemic dengue found in Sumatra is transmitted by the yellow fever mosquito as well as by *A. albopictus*. For the endemic Sumatran dengue the authors have been able to confirm the findings of Cleland et al. for Australia (E. S. R., 39, p. 263) [3], Siler et al. for the Philippine Islands (E. S. R., 53, p. 654), and G. Blanc and J. Caminopetros for Greece [4], viz, that the dengue fevers are transmitted by the yellow fever mosquito. Moreover, they were able to confirm the finding of Simmons et al. for the Philippine Islands (E. S. R., 63, p. 258), viz, that *A. albopictus* also plays a part as transmitter.

The work *of the* Anti-Malaria Commission in combating malaria in Egypt (*Egypt Govt. Anti-Malaria Comn. Rpt. 5* (*1928–29*), *pp.* [*2*]+*12, pls. 6*).—

[3] Jour. Hyg. [London], 18 (1919), No. 3, pp. 217–254, figs. 9.
[4] Ann. Inst. Pasteur, 44 (1930), No. 4, pp. 367–436, figs. 12.

This is a detailed account of mosquito control work during the fiscal year 1928–29, accompanied by six inserted maps.

The buffalo fly (Lyperosia exigua de Meijere), F. H. S. ROBERTS (*Queensland Agr. Jour., 35 (1931), No. 3, pp. 163–166, fig. 1*).—A practical account of this pest under Australian conditions.

Some observations on the seasonal and regional incidence of blowflies in the south-west of Western Australia, L. J. NEWMAN, B. A. O'CONNOR, and H. G. ANDREWARTHA (*Jour. Dept. Agr. West. Aust., 2 ser., 7 (1930), No. 4, pp. 592–600, figs. 10*).—Notes and tabular data are given on five of the more important flies met with in the southwest of Western Australia, namely, *Lucilia sericata* (Meig), *Chrysomyia rufifacies* (Macq.), *Calliphora australis* (Boisd.), *Microcalliphora varipes* (Macq.), and *Calliphora* sp.

The correct name of a Negros white grub, A. W. LOPEZ (*Sugar News, 12 (1931), No. 5, p. 299, fig. 1*).—The author reports upon one of the more important cane beetles found in Occidental Negros, P. I., which has been determined by E. A. Chapin to be *Stephanopholis philippinensis* Brenske. The duration of the first stage of the grub under laboratory conditions has been found to average 79.4 days, with a range of from 65 to 94 days. The article is in English and Spanish.

The predatory enemies of Elateridae (Coleoptera), C. A. THOMAS (*Ent. News, 42 (1931), No. 6, pp. 158–167*).—This review of the literature on the natural control of the Elateridae, or click beetles, and their larvae, the wireworms, indicates that the predatory enemies exert considerably more control than is caused by their parasitic enemies. Of the predators, birds, both wild and domesticated, are of the most value, with the predacious Carabidae, or ground beetles, the second in importance. Toads, frogs, moles, and certain dipterous larvae probably also have considerable value.

A list is given of 69 references to the literature.

The occurrence of a beetle (Onthophagus granulatus Bohen) in the stomach of domesticated animals, F. H. S. ROBERTS (*Queensland Agr. Jour., 35 (1931), No. 3, p. 171*).—This note records the presence of the beetle *O. granulatus* in the stomach of the horse and calf.

On the infestation of elm bark-beetles (Scolytidae) by a nematode, Parasitylenchus scolyti n. sp., J. N. OLDHAM (*Jour. Helminthol., 8 (1930), No. 4, pp. 239–248, figs. 2*).—This account includes a description of *P. scolyti* n. sp., taken from the body of the large elm bark beetle (*Scolytus destructor* Ol.). This parasite has been found to exercise an appreciable controlling effect on the bark beetles *S. destructor* and *S. multistriatus* Ratz.

A revisional study of the genus Pseudopityophthorus Sw. in North America, M. W. BLACKMAN (*Jour. Wash. Acad. Sci., 21 (1931), No. 10, pp. 223–236, figs. 15*).—This is a paper in continuation of a large paper on the genus Pityophthorus and its allies in North America published in 1928 (E. S. R., 61, p. 661).

Investigations of the morphology and biology of the seed weevils (Bruchidae-Lariidae).—VI, Contributions to the knowledge of the stored product insects [trans. title], F. ZACHER (*Arb. Biol. Reichsanst. Land u. Forstw., 18 (1930), No. 3, pp. 233–384, figs. 99*).—This contribution reports upon the morphology and classification of the seed weevils (pp. 236–296), their biology and ecology (pp. 296–368), and control measures (pp. 368–377). The seed weevils *Zabrotes* (*Spermophagus*) *subfasciatus* Boh. (pp. 336–273), the bean weevil (pp. 274–277), *Bruchus analis* (pp. 277–279), *Bruchidius dentipes* Baudi (p. 280), *B. incarnatus* Boh. (pp. 280–282), and the cowpea weevil (pp. 282, 283) are dealt with. A bibliography of seven pages is included.

The strawberry root weevil, with notes on other insects affecting strawberries, W. DOWNES (*Canada Dept. Agr. Pamphlet 5, n. ser., 2. rev. ed. (1931), pp. 19, figs. 8*).—This revision (E. S. R., 47, p. 757) includes means of control.

The raspberry weevil (Anthonomus rubi Herbst), an important pest in parts of Sweden [trans. title], A. LINDBLOM (*Meddel. Centralanst. Försöksv. Jordbruksområdet [Sweden], No. 375 (1930), pp. 39, figs. 13; Ger. abs., pp. 33–37*).—A summary of information on this pest which includes a list of 54 references to the literature.

The mango weevils, W. D. PIERCE (*Jour. Wash. Acad. Sci., 21 (1931), No. 8, pp. 176, 177*).—Notes are presented on the synonymy of weevils of the genus Sternochetus, to which genus four of the weevils that breed in the seed of mango belong.

Package bees, A. V. MITCHENER (*Manitoba Dept. Agr. and Immigr. Ext. Bul. 97 (1931), pp. 19, figs. 9*).—A practical summary of information.

Chalcid control in alfalfa-seed production, V. L. WILDERMUTH (*U. S. Dept. Agr., Farmers' Bul. 1642 (1931), pp. II+14, figs. 12*).—This is a revision of and supersedes Farmers' Bulletin 636, previously noted (E. S. R., 32, p. 454).

On the oviposition of hymenopterous entomophagous parasites [trans. title], H. and P. VOUKASSOVITCH (*Compt. Rend. Soc. Biol. [Paris], 106 (1931), No. 8, pp. 695–697*).—Notes are presented on the oviposition of the chalcid parasite *Habrocytus saxeseni* Ratz. and observations of *Nemeritis canescens* Grav. and *Elasmus flabellatus* Westw.

On the combat for possession of the host by the larvae of solitary ectoparasites [trans. title], H. and P. VOUKASSOVITCH (*Compt. Rend. Soc. Biol. [Paris], 106 (1931), No. 8, pp. 697–700*).—An account of observations made in the course of the studies above noted.

Notes on ichneumon-flies of the genus Polycyrtus, with descriptions of new species, R. A. CUSHMAN (*U. S. Natl. Mus. Proc., 78 (1931), Art. 14, pp. 62, figs. 8*).—Thirty-six of the 53 species here recognized are described as new. It is pointed out that nothing appears to be known of the host relations of these species.

On certain hymenopterous parasites of stored-grain insects, A. B. GAHAN (*Jour. Wash. Acad. Sci., 21 (1931), No. 10, pp. 213–221, figs. 9*).—This account deals with parasites of the family Bethylidae, which attack stored-grain insects, including one new to science.

A revision of the species of Coccophagus, a genus of hymenopterous, coccid-inhabiting parasites, H. COMPERE (*U. S. Natl. Mus. Proc., 78 (1931), Art. 7, pp. 132, pls. 14*).—Seventy-six species of the genus are recognized, of which 21 are described as new. A list of species, mostly European, that remain unrecognized is appended.

Notes on some parasites reared from flea-beetles of the genus Phyllotreta (Chrysomelidae), H. C. F. NEWTON (*Ent. Mo. Mag., 3. ser., 17 (1931), No. 196, pp. 82–84*).—In this contribution from the Rothamsted Experimental Station, notes are presented on several parasites of the larval and adult stages of flea beetles.

[Contributions on hymenopterous parasites] (*Calif. Univ. Pubs. Ent., 5 (1931), Nos. 11, pp. 233–245, figs. 3; 12, pp. 247–255; 13, pp. 257–264, figs. 3*).—Three contributions are here presented: A Revision of the Genus Diversinervus Silvestri, Encyrtid Parasites of Coccids (Hymenoptera) (pp. 233–245), including 3 new species; A Discussion of the Parasites of *Saissetia oleae* (Bern.) Collected in Eritrea (pp. 247–255), with descriptions of 2 new species; and The African Species of Baeoanusia, an Encyrtid Genus of Hyperparasites (Hymenoptera) (pp. 257–264), all by H. Compere.

The present status of the larch sawfly (Lygaeonematus erichsonii Hartig) in Canada, with special reference to its specific parasite, Mesoleius tenthredinis Morley, A. R. GRAHAM (*Canad. Ent., 63 (1931), No. 5, pp. 99–102*).—The author has found that the specific parasite *M. tenthredinis* of the larch sawfly has become established in Manitoba and Quebec and at St. Williams and Busteed, Ont. This parasite was undoubtedly instrumental in reducing the larch sawfly population in Manitoba to a minimum.

Transmission of Anaplasma marginale by Rhipicephalus bursa and by Margaropus [trans. title], E. BRUMPT (*Ann. Parasitol. Humaine et Compar., 9 (1931), No. 1, pp. 4–9*).—A report upon tick transmission experiments with *A. marginale*, conducted in Paris.

Transmission of the Mediterranean kala azar by the tick Rhipicephalus sanguineus [trans. title], G. BLANC and J. CAMINOPETROS (*Compt. Rend. Acad. Sci. [Paris], 191 (1930), No. 23, pp. 1162–1164*).—The authors find that the larvae and the nymphs of the brown dog tick become infected through engorging on animals naturally or experimentally infected with kala azar, and that such ticks continue infected even after molting.

ANIMAL PRODUCTION

A third of a century of feeding-stuff inspection, J. L. HILLS (*Vermont Sta. Bul. 324 (1930), pp. 48, figs. 10*).—In this publication the author pictures the status of feeding stuffs prior to the passage of the feed control law and compares it with the situation after the law had been in effect for a few years and with the present status. The results in terms of guaranty maintenance by present-day licensees over a period of several years are given in table form, as are also the amount of feeding stuffs used in the State, in several of the counties, and the per farm usage covering the period from 1910 to 1925. The relationship of the use of feeding stuffs to milk production is presented.

Inspection of feeds, W. L. ADAMS and A. S. KNOWLES, JR. (*Rhode Island Sta. Ann. Feed Circ., 1931, pp. 12*).—The guaranteed and found analyses for protein and fat are presented for 221 samples of feeding stuffs collected for official inspection in 1930 (E. S. R., 63, p. 556).

Commercial feeding stuffs, L. S. WALKER and E. F. BOYCE (*Vermont Sta. Bul. 321 (1930), pp. 43*).—The usual report of the analyses for protein, fat, and fiber of 1,651 samples of feeding stuffs collected for official inspection during April, 1930. The brands fulfilling their guaranties and the analyses of brands failing to meet their guaranties are listed (E. S. R., 63, p. 856).

The calcium content of striated muscle of rachitic animals, V. G. HAURY (*Jour. Biol. Chem., 89 (1930), No. 1, pp. 467–469*).—Analyses of the striated muscles of rachitic rats showed definite and marked decreases in the calcium content. The average calcium content of rachitic rats was 41.6 mg. per 100 gm. of dry muscle, while the average for normal rats was 74 mg.

Comparison of rations for fattening calves, W. L. BLIZZARD (*Cattleman, 18 (1931), No. 1, p. 9*).—In this study at the Oklahoma Experiment Station 6 lots of 10 steers each, averaging approximately 400 lbs. per head, were fed for 164 days. Ground shelled corn was full-fed to the first 5 lots and ground wheat to lot 6. Cottonseed meal was fed at the rate of 1.5 lbs. per head in lots 1 and 6, 2.5 lbs. in lots 2 and 4, and 3.5 lbs. in lot 3, while ground limestone was fed at the rate of 2 per cent of the grain ration in all lots except lot 4. Prairie hay was fed to all lots.

The average daily gains were 2.2, 2.22, 2.29, 2.17, 1.23, and 2.01 lbs. per head in the respective lots. The feed cost per 100 lbs. of gain was cheapest in lot 6

followed in order by lots 1, 2, 3, 4, and 5. There were no ill effects from the feeding of a large amount of cottonseed meal in lot 3. Steers in lot 4 receiving no limestone made smaller gains at a higher cost than the steers in lot 2 receiving the same ration with the addition of limestone. In lot 5 the steers receiving no protein supplement made the poorest gains, required the largest amount of feed, and cost more per unit of gain than in any of the other lots. Feeding wheat in lot 6, in addition to producing the cheapest gains, gave a very even finish.

The average ages of cows and bulls in six breeds of cattle, A. D. B. Smith and O. J. Robison (*Jour. Agr. Sci.* [*England*], *21* (*1931*), *No. 1, pp. 136–149*).—The material for this study at the University of Edinburgh, Scotland, was taken from the herd book records of the Shorthorn, Aberdeen-Angus, Hereford, Ayrshire, Jersey, and British Friesian breeds. The ages of the parents of 2,618 pedigreed calves were tabulated.

The average of all cows calving was found to be 5.722±0.04 years with a standard deviation of 2.816. For the dairy breeds the average age was 5.485±0.05 years and for the beef breeds 6.022±0.05 years. It was found that it required annually 27 per cent of the cow population for use as replacements to take care of the losses. It is suggested that if this replacement figure could be reduced a better selection of the female stock could be effected.

The average age of the bulls of all breeds at the time their progeny was born was 3.846±0.03 years with a standard deviation of 1.943. For the dairy breeds the average age was 3.687±0.03 years and for the beef breeds 4.052±0.04 years. The annual replacement figure for all breeds was 54 per cent, of which 60 per cent were dairy bulls and 49 per cent beef bulls. Reducing the replacement figure in the case of the bulls would also permit a surer method of stock improvement.

No definite relationship was found in the proportion of the sexes of the calves and the age of their parents.

The Missouri plan of sheep improvement, J. W. Burch (*Missouri Agr. Col. Ext. Circ. 263* (*1930*), *pp. 19, figs. 6*).—A plan for assisting farmers with their sheep production problems and for improving the quality of market lambs is discussed in this circular.

Sheep management in Oklahoma, A. E. Darlow (*Okla. Agr. Col. Ext. Circ. 272* (*1931*), *pp. 29, figs. 24*).—This is a popular publication discussing the breeding, feeding, and management of sheep under Oklahoma conditions.

Relation of size of grade fine wool ewes to their production, W. E. Joseph (*Montana Sta. Bul. 242* (*1931*), *pp. 15, figs. 8*).—Continuing this study (E. S. R., 64, p. 254), an effort was made to obtain a basis for selecting fine wool ewes for the production of more wool and lambs. A group of 277 ewes was divided into weight classes. It was found that there was a progressive increase in the weights of the average lamb crops as the weights of the ewes increased. There was an extreme spread of 21 lbs. between the weight of the lamb crops from the lightest to the heaviest ewes. There was also a tendency for the heavier ewes to raise a larger percentage of twins and to raise pairs of twins that were heavier. The heavier ewes also produced heavier fleeces with a maximum spread of 1 lb.

These tests were also conducted with 88 ewes out of the foundation ewes and sired by Rambouillet rams. Although these ewes averaged 20 lbs. heavier than their dams, the relations between the weights of average lamb crops and weight of ewes was the same. Practically the same results were also obtained in regard to twins and to wool production.

Part of the difference in weights of lamb crop for both series of ewes was due to the higher percentage of twins raised by the heavier ewes. The failure to

raise a lamb crop one year in five did not affect the relation of the average weight of lamb crops raised to the weight of the ewes. The condition of the single lambs raised showed a close relationship to the weights at weaning time. Practically all the lambs that weighed over 90 lbs. were graded as medium to good killers, while single lambs weighing from 80 to 90 lbs. were about evenly divided between medium to good killers and well-fleshed feeders, and lambs weighing under 80 lbs. were mostly placed in the feeder class.

The results show that culling the small ewes would have eliminated no exceptional lamb producers and few that were equal to the average. There were no indications that one weight class of ewes had any tendency to fail to produce a lamb crop more often than any other class. Preliminary results indicated that the size of a ewe was a more accurate measure of her ability to raise heavy lamb crops than was the lamb-producing ability of her dam. While size was not the sole criterion in selection, this work shows that it was the most accurate single measure for the selection of fine wool ewes.

The utilization of oil cakes for bacon production [trans. title], N. V. TATARINOVA and M. DEMUROV (DEMOUROV) (*Trudy Otd. Zootekh. Gosud. Inst. Opytn. Agron. [Leningrad]* (*Works Bur. Anim. Indus., State Inst. Expt. Agron.*), *3 (1928), pp. 97–146, figs. 3*).—Feeding tests with young pigs showed that while the addition of 10 per cent of linseed cake to the ration was beneficial, 25 per cent decreased the quality of the bacon but did not noticeably affect the rate of gain, and 50 per cent of the cake was impractical. The use of 10 per cent of sunflower cake with corn or barley increased the rate of gain and produced bacon of medium quality. Larger amounts of this cake produced a side of bacon containing too much fat. Cottonseed meal was found to contain some toxic properties, and the substitution of pea flower for oil cakes was unsatisfactory.

The iodine number, melting point, and point of solidification were determined on samples of fat taken from the backs of living pigs from time to time during the feeding tests. The method of sampling is described and illustrated.

The Missouri plan of growing thrifty pigs, J. W. BURCH (*Missouri Agr. Col. Ext. Circ. 259 (1930), pp. 12, figs. 6*).—The sanitary system that should be followed to insure healthy, normal pigs, and the method of feeding such pigs are described in this publication.

Soft pork studies.—IV, The influence of a ration low in fat upon the composition of the body fat of hogs, N. R. ELLIS and J. H. ZELLER (*Jour. Biol. Chem., 89 (1930), No. 1, pp. 185–197*).—Continuing this study (E. S. R., 55, p. 264), the present work was undertaken to determine the quantity and composition of the body fat of hogs at successive stages of growth, using brewers' rice as a basal feed. A Chester White and a Duroc-Jersey sow were placed on a ration of brewers' rice, alfalfa meal, and blood meal during the pregnancy period, and both farrowed large, normal litters. Of the 17 pigs alive at the end of 6 weeks, 13 were selected for the study. Two pigs were killed when the suckling period was half over and two more at weaning time. After weaning the remaining pigs were placed on a ration of brewers' rice, blood meal, alfalfa meal, and a mineral mixture, and the nutritive ratio of this ration was adjusted to meet the requirements of the pigs as they increased in weight. The pigs were slaughtered in pairs at weights approximating 75, 110, 170, and 240 lbs. per head and the remaining pig at 300 lbs. The same general plan of slaughter and analysis was used as in the previous work.

The analyses showed that pigs on a ration low in fat synthesized and stored fat at a normal rate, and the lack of fat from the diet did not appear to exert any material influence on the degree of fattiness. Hard, saturated fats

were formed in the young pigs, and there was a gradual increase in saturation up to about 100 lbs. in weight, above which extremely hard fat was produced. The principal fatty acids of the body fat were oleic, palmitic, and stearic, while small amounts of linolic, myristic, and arachidonic acids were also found. The principal change in the composition of the body fat occurred in the linolic acid content, which had its maximum content at the suckling pig stage, and gradually decreased up to a weight of 170 lbs. This change appeared to account for the increase in saturation which accompanied increased live weight.

The embryology of the pig, B. M. PATTEN (*Philadelphia: P. Blakiston's Son & Co., 1931, 2. ed., pp. IX+327, pl. 1, figs. 168*).—A treatise in which the fundamental facts concerning the development of the pig are set forth in brief and simple form.

Practical light horse breeding, J. F. WALL (*Washington, D. C.: Amer. Remount Assoc., 1931, pp. 171, figs. 100*).—In this treatise dealing with the breeding, feeding, and management of light horses, the author has compiled the experience of many breeders into a practical handbook.

Heart probe—a method for obtaining blood samples from chickens, H. J. SLOAN and H. S. WILGUS, JR. (*Poultry Sci., 10 (1930), No. 1, pp. 10–16*).—A method developed by the New York Cornell Experiment Station for obtaining blood for analysis from the hearts of chicks and mature fowls by probing the heart with a hypodermic needle is described in this paper. The advantages of this method are that large amounts of blood uncontaminated by other body fluids can be obtained, the birds do not have to be killed, many samples may be taken in a relatively short time, the mortality rate is low, no particular skill is needed for the operation, and the samples obtained are well suited to the more common methods of calcium and phosphorus analyses.

Collection and analysis of chicken urine, E. J. COULSON and J. S. HUGHES (*Poultry Sci., 10 (1930), No. 1, pp. 53–58, fig. 1*).—A method for collecting urine for analysis directly from the cloaca of the hen by means of a suitable catheter is described in this paper from the Kansas Experiment Station. An analysis of the urine of 15 White Leghorn hens that had been kept under normal conditions is given in tabular form.

A method of calculating coefficients of digestibility of poultry feed, V. G. HELLER, L. MORRIS, and H. E. SHIRLEY (*Poultry Sci., 10 (1930), No. 1, pp. 3–9*).—In this paper from the Oklahoma Experiment Station a method is suggested for calculating coefficients of digestibility of poultry feeds. The method is shorter than others formerly used, and eliminates ascertaining exactly the food wasted, the total excreta, and the tedious methods of determining uric acid and ammonia salts. In the suggested method distilled drinking water is used, and it is necessary to prevent contamination of the feces. In addition to the usual proximate analysis of feeds, an analytical determination of iron which is comparatively short, but which requires considerable care and technic, is introduced in this method.

Poultry feeding experiments, C. L. MORGAN (*South Carolina Sta. Bul. 273 (1931), pp. 16, figs. 3*).—The three studies reported in this bulletin conclude work previously noted (E. S. R., 64, p. 667).

I. *Cottonseed meal in laying and breeding rations*.—Cottonseed meal proved to be a satisfactory substitute for meat scrap in the laying mash when supplemented with a mineral mixture containing phosphorus, calcium carbonate, and sodium chloride. Cottonseed meal did not affect the fertility of the eggs, but when it replaced all the meat scrap in the mash the hatchability was very unsatisfactory. When it replaced half the meat scrap the hatchability was

reduced only slightly. Cottonseed meal fed to breeding stock had no effect on the size of the chicks hatched, their subsequent growth, or the maturity of the pullets when fed a standard ration. Feeding cottonseed meal did not affect the weight or quality of the fresh eggs or the weight or health of the hens. The use of cottonseed meal in the ration should be determined by its price as compared with meat scrap.

II. *Skim milk v. meat scrap as supplements to cottonseed meal.*—As supplements to cottonseed meal in laying rations skim milk and meat scrap were equal in feeding value. For breeding hens skim milk was somewhat less valuable than meat scrap, reducing both fertility and hatchability slightly. At usual prices the skim milk ration made slightly less return over feed cost than the meat scrap ration.

III. *Ground barley v. ground yellow corn in the mash for layers and breeders.*—In this study it was found that ground barley could successfully replace ground yellow corn in the laying mash when the scratch grain contained a large proportion of shelled yellow corn and when green feed was available. Under these conditions ground barley did not affect the fertility or hatchability of the eggs. The use of ground barley should depend upon the price of barley and yellow corn and the availability of sources of vitamin A.

Studies on the influence of free choice of feed in poultry feeding, V. G. Amon (*Philippine Agr., 19 (1930), No. 7, pp. 445–470, figs. 6*).—This study at the University of the Philippines was conducted to determine the effect of free-choice feeding on the growth and egg production of pullets. The phase with laying pullets covered a period of one year, while the chick study was run for 24 weeks. The birds in both groups were divided into three lots and fed free choice, grain and mash with the proportions optional to the birds, and grain and mash equal parts.

The method of feeding had no appreciable effect on the rate of growth of the chicks, and at 24 weeks of age the difference in the weight of pullets was insignificant. The birds fed free choice consumed the most feed, and the birds fed the grain and mash in optional amounts consumed the least. The mortality and the rate of maturity was not influenced by the system of feeding.

The free-choice birds produced the smallest number of eggs with the other two lots having about the same production, but the lot fed optional amounts of mash and grain have the greatest return above feed cost. Both chicks and pullets consumed more grain and mash when allowed to choose their feed.

Morphological changes in the organism of chickens at prolonged periods of feeding [trans. title], A. A. Selezneva (*Trudy Otd. Zootekh. Gosud. Inst. Opytn. Agron. [Leningrad] (Works Bur. Anim. Indus., State Inst. Expt. Agron.), 3 (1928), pp. 185–206, figs. 10*).—Macroscopic and microscopic examination of samples of various organs from the bodies of chickens that had been fed different rations led to the conclusion that the deposition of fat and the increase in muscle fibers were characteristic of the breed of birds and not dependent on feed alone.

The quantitative requirement of the growing chick for calcium and phosphorus, H. S. Wilgus, Jr. (*Poultry Sci., 10 (1931), No. 3, pp. 107–117, figs. 2*).—In this study at the New York Cornell Experiment Station 10 pens of 45 day-old White Leghorn chicks each were fed for 16 weeks on the same basal ration. Varying amounts and proportions of tricalcium phosphate and calcium carbonate were added to the basal ration in several lots. At the end of 8, 12, and 16 weeks, 4 representative cockerels and 4 pullets were removed from each lot and used for blood and bone ash analyses. The second test, consisting of 10 pens of 43 chicks each, was conducted in the same manner except that 0.5

per cent of cottonseed oil was substituted for a like amount of cod-liver oil in some lots. This was done to study the effect of varing amounts of antirachitic factor on the calcium and phosphorus requirements.

The results indicated that when an optimum amount of antirachitic factor was supplied, the calcium requirement of the growing chick neared a minimum level of 0.66 per cent and a phosphorus requirement of 0.5 per cent or less. Usually practical mashes contain about 1.2 per cent of calcium and a larger amount of phosphorus than is required. For normal growth the calcium-phosphorus ratio could vary between 1:1 and 2.2:1, while a ratio of 2.5:1 was on the border line and a ratio of 3.3:1 resulted in nutritional disturbances.

Calcium-phosphorus metabolism in the chicken.—I, The effect of irradiated ergosterol (vitamin D), G. E. Hall and E. J. King (*Poultry Sci., 10 (1931), No. 3, pp. 132–153, figs. 5*).—In this study 27 Barred Plymouth Rocks, 16 weeks of age and of known history, were divided into 3 lots of 9 birds each and fed a basal ration known to produce 100 per cent rickets in 8 weeks. Lot 1 was divided into 3 groups, 1 of which received 1 drop of Vigantol (a standard preparation 100 times as potent as standard cod-liver oil, containing 0.6 mg. of irradiated ergosterol per cubic centimeter) every other day. Another group received 1 drop daily, and the third group 2 drops daily. Lot 2 was similarly divided and the respective groups received 1, 3, and 6 cc. daily of Vigantol for the first 6 weeks. Beginning the seventh week, all the birds in lot 2 received the same number of cubic centimeters of a special concentrated solution of ergosterol (1,500 times the potency of cod-liver oil), which was equivalent to 9, 27, and 54 mg. of ergosterol per bird per day. Lot 3 received no supplement to the basal ration.

The birds in lot 1 remained normal throughout the test, and several pullets had started to lay before being killed for analyses. In lot 2 the birds grew normally for 5 or 6 weeks and increased in weight to the ninth week. After the ninth week the birds became anemic, weak legged, and developed a peculiar sore eye. The birds in lot 3 were slightly heavier at the beginning of the test than the other lots and they gained faster during the test, but 100 per cent leg weakness was produced on their ration and definite rachitic symptoms were manifested by all birds as early as the eighth week.

An analysis of the blood serum showed that after a first decrease in calcium values the levels for lots 1 and 2 were more or less steady, but the calcium value for lot 3 gradually decreased for about 12 weeks, after which it remained fairly constant. Variations for the inorganic phosphorus were smaller than for calcium, the level being about the same for all 3 lots for 9 weeks. At this time the level of lot 2 gradually decreased, and that of lot 3 increased for a time and then returned to a subnormal level. Analyses for phosphatase, an enzyme regarded as an active agent in bone ossification, showed that there was about 6 times as much of this enzyme present in the bones of lot 1 as in lot 2, and that lot 3 had twice as much as lot 1. An analysis of various tissues and organs for phosphatase showed no significant difference between the normal and the rachitic birds.

Using the birds in lot 1 as normals, histological studies of several organs showed that a rachitic diet or an overdose of irradiated ergosterol had no significant effect on the aorta, kidney, liver, or small intestines. However, the testes of the birds in lot 3 appeared to be very hyperplastic, a condition not found in the other groups. The bones of the birds in lot 2 showed a thin, weakened shaft filled with dense, jelly-like marrow, while those of the birds in lot 3 were usually brittle but larger, often flattened and decidedly curved, and the marrow did not show the same gelatinous consistency as that in lot 2.

There was a decided similarity between X-ray and histological pictures of the bones.

The study shows that prolonged or large doses of Vigantol fed to chickens led to loss of appetite, followed by loss in weight and in all cases by rather severe malnutrition and death. The injurious effects due to the administration of excessive doses of irradiated ergosterol may be considered as hypervitaminosis.

Deficiencies of synthetic diets in chick nutrition, A. G. Hogan and C. L. Shrewsbury (*Jour. Nutrition, 3 (1930), No. 1, pp. 39–48, figs. 4*).—Continuing the study of synthetic diets at the Missouri Experiment Station (E. S. R., 54, p. 270), the experimental procedure was not changed and the White Leghorn chicks, which were used exclusively, were all reared under strictly laboratory conditions. The basal ration used consisted of casein, cornstarch, dried yeast, lard, cod-liver oil, cellulose, and salt mixture 35 : 28 : 15 : 10 : 5 : 3 : 4. The experimental rations in most cases differed from the basal ration chiefly in the source, or amount, of the vitamin B carriers.

It was found that simplified rations must be fortified with approximately 40 per cent of dried yeast to be adequate for the chicks. The active constituents of fresh yeast are easily obtained in water-soluble form, and on a dry basis 20 per cent of the water extract is practically equivalent to 40 per cent of dried yeast.

The occurrence in chicks of a paralysis of nutritive origin, L. C. Norris, G. F. Heuser, H. S. Wilgus, jr., and A. T. Ringrose (*Poultry Sci., 10 (1930–31), No. 2, pp. 93–97, fig. 1*).—Continuing this study (E. S. R., 63, p. 863) and taking exception to the conclusions of Hart and his coworkers (E. S. R., 64, p. 467), the authors obtained further evidence in support of their conclusion that milk contains a factor, vitamin in nature, which prevents the development of a peculiar paralysis involving the legs and feet of chicks. The factor is also found in a vitamin concentrate from milk, in yeast, autoclaved yeast, and alfalfa meal. Meat scrap, menhaden fish meal, and dried whale meat may be deficient in this factor.

The permanency of cod liver oil vitamins in stored feeds, A. D. Holmes, M. G. Pigott, and D. F. Menard (*Poultry Sci., 10 (1930), No. 1, pp. 37–52, figs. 5*).—In this study 4 tests were made with 2 series of pens each with Rhode Island Red chicks which were housed in battery brooders and fed all-mash rations for 8 weeks. One series received cod-liver oil freshly mixed with the mash, while the second series received the same amounts of oil which had been incorporatd by a commercial feed mill into the mash. Mashes were used which had been stored with the incorporated oil for 2, 4, 7, and 10 months. One check group was fed without any oil.

The control lot did not grow satisfactorily, failed to feather, and became rachitic. The rate of growth of the chicks receiving oil increased with the increasing amounts of oil fed, regardless of whether it was freshly added or stored in the mash. A histological examination of the tibiae removed from chicks on the twenty-first, thirty-fifth, and fifty-sixth days showed that the bone development for comparable amounts of cod-liver oil was equal whether the oil was freshly added to the mash or had been stored in it. The results of this study indicate that adding low acid, vitamin-rich cod-liver oil to finely ground poultry mashes under commercial mill procedure does not decrease its vitamin value during storage of the mash for periods up to one year.

Antirachitic value of S–1 lamp radiation for chicks, F. E. Mussehl and C. W. Ackerson (*Poultry Sci., 10 (1930–31), No. 2, pp. 68–70, fig. 1*).—A basal all-mash ration was fed for 8 weeks to 4 lots of 35 chicks each in this study at the Nebraska Experiment Station. Lot 1 received the basal ration only;

lot 2, in addition, 1 per cent of cod-liver oil; lot 3, direct sunlight ad libitum; and lot 4 was irradiated for 20 minutes daily at a distance of 60 in. with a Sunlight (type S-1) lamp, which was supposed to produce a spectrum like that of unfiltered sunlight.

In lot 1, 26 of the 30 surviving birds showed distinct symptoms of rickets, which was not evident in the other lots. The percentages of ash in the tibiae of representative birds from the respective lots were 37.64, 45.74, 46.01, and 40.92. These results indicate that the radiation produced by the Sunlight lamp has definite antirachitic properties.

Ultra-violet light in poultry production, L. C. PRICKETT (*Agr. Engin.*, *12* (*1931*), *No. 3*, *pp. 79, 80*, *figs. 3*).—A brief review of the progress made in the use of ultra-violet light in poultry production is presented as a contribution from the Committee on the Relation of Electricity to Agriculture.

All-night light for layers, D. C. KENNARD and V. D. CHAMBERLIN (*Ohio Sta. Bul. 476* (*1931*), *pp. 22*, *figs. 10*).—Continuing this study in the management of birds (E. S. R., 63, p. 563), it was found that the use of all-night lights for pullets or hens increased winter egg production as compared with no lights or with morning light at 4 a. m. However, since birds with morning lights produced more spring eggs, it is recommended that for producing a uniform supply of hatching or special market eggs in February and March a certain number of the birds be carried throughout the winter months without lights. The use of all-night lights made possible winter production from selected yearling hens and the use of eggs from these hens for hatching in January and February rather than eggs from pullets.

All-night lights had no bad effects upon the fertility or hatchability of eggs produced and were valuable for bringing slow-maturing, late-hatched, or inferior pullets into production. They were also effective for preventing premature fall or winter molt and assisted pullets which had started to molt in October to make a rapid recovery in egg production. Hens that molted in September and were given all-night lights laid 42 per cent more eggs and consumed 10 per cent more feed from November 13 to March 4 than a similar lot without lights.

The most effective results were obtained from all-night lights when the birds were supplied with enough fresh coarsely ground mash in open box-type feeders to last during the night. A well-insulated laying house which kept the temperature from going below 35 to 40° F. was necessary in order that the birds might maintain their usual activity both day and night.

The houseless method of poultry keeping, B. W. HEYWANG and M. A. JULL (*Poultry Sci.*, *10* (*1930*), *No. 1*, *pp. 32–36*, *fig. 1*).—In this study at the U. S. Poultry Experiment Station, Glendale, Ariz., White Leghorn pullets were divided into two lots of 150 each when removed from the brooder house, and were fed the same rations. For one lot the roosts were entirely unprotected but the trap nests, water containers, and feed hoppers were placed under a shade made of palm leaves, while the roosts and other equipment for the second lot were placed in a house of the type recommended for this section. Records were maintained on the two groups for a period of 14 months.

The birds in lot 1 matured faster and had a lower mortality rate than those in lot 2. Lot 1 consumed somewhat more feed during the growing period and slightly less feed for the entire laying period than lot 2. There was practically no difference in the average egg production or average feed cost per dozen eggs in the two lots. Hatchability of eggs was slightly lower in lot 1 than in lot 2. The light precipitation and absence of cold weather in this region were responsible for the success of keeping poultry without houses.

Turkeys, E. N. HOLMGREEN (*Texas Agr. Col. Ext.* [*Bul.*] *72* [*1931*], *pp. II+17, figs. 11*).—The successful breeding, feeding, and management of turkeys under Texas conditions are described in this bulletin.

DAIRY FARMING—DAIRYING

[**Experiments with dairy cattle in Vermont**] (*Vermont Sta. Bul. 319* (*1930*), *pp. 13, 14, 17*).—The results of three studies are noted.

Effect of the nutritional plane on utilization of nutrients by the dairy cow, including the consideration of sundry phases of mineral metabolism.—Continuing this study (E. S. R., 62, p. 370), two lots of two cows each were fed through full lactation periods on a basal ration of timothy hay, corn silage (replaced by grass in summer), and a grain mixture. Equal parts of steamed bone meal and finely ground limestone were fed at the rate of 75 gm. per head daily to the cows in lot 1. All the animals finished the year with positive balances for both calcium and phosphorus. Adding the mineral supplement shortened the period of calcium loss, equilibrium being reached in from 10 to 20 weeks for the mineral-fed lot and in from 20 to 45 weeks for the lot receiving no minerals. Negative phosphorus balances lasted only a short time in both lots. The results indicate that cows receiving good roughage and a grain mixture do not need mineral supplement.

Composition and yield of pasture grass.—In this phase of the study (E. S. R., 62, p. 252), two similar areas of uniform grass were selected, and one was used as a check while the other was grazed, the difference in the weight of the grass at the end of 24 hours being taken as an indication of the amount eaten. A 1,300-lb. Holstein cow, producing 38 lbs. of milk and consuming 9 lbs. of grain per day, ate an average of 58 lbs. of grass, while an 800-lb. dry Guernsey cow, receiving no grain, ate an average of 43 lbs. of grass.

Fish meal as a feed for farm stock.—A group of heifers fed a ration containing fish meal as a high protein supplement appeared to be in the same condition at 2 years of age as a group receiving cottonseed meal. The group fed fish meal appeared to eat their feed well.

In a test with 2 groups of 6 cows each fed through 3 periods of 4 weeks each by the reversal method, there were no physical differences in the cows fed fish meal and those on the check ration. Some of the cows, however, refused to eat the fish meal after a few days, even when brought to a full feed slowly. Other cows, while apparently not relishing the fish meal, ate it when it was well mixed with silage.

Feeding the dairy herd, W. B. NEVENS (*Illinois Sta. Circ. 372* (*1931*), *pp. 52, figs. 14*).—A popular publication describing the feeding of various classes of dairy cattle. The characteristics of the ideal ration, the composition of feeds, calculating the relative economy of feeds, a simple method of balancing rations, some common problems in dairy feeding, and the feeding value and quality of individual feeds are also described.

Feeding, care, and management of dairy calves and heifers, J. O. TRETSVEN (*Mont. Agr. Col. Ext. Bul. 110* (*1930*), *pp. 16, figs. 15*).—This is a popular bulletin, in which the important steps in the feeding, care, and management of dairy calves are discussed.

Calf rearing, J. F. BLACKSHAW ([*Gt. Brit.*] *Min. Agr. and Fisheries Bul. 10* (*1930*), *pp. V+17*).—A brief account of the methods of raising calves that have proved successful in various sections of England is given in this bulletin.

Proved sires profitable, E. J. PERRY (*N. J. Agr. Col. Ext. Bul. 82* (*1931*), *pp. 15, figs. 8*).—The results of using proved bulls for the improvement of dairy

herds, together with information on the housing and feeding of bulls, are presented.

Correlation between annual butter fat production and annual feed cost of dairy cows under farm conditions, C. W. McIntyre (*Jour. Dairy Sci., 14 (1931), No. 1, pp. 73–83, figs. 5*).—This study was based on records of the Jackson County, Mo., Dairy Herd Improvement Association.

The results showed that under farm conditions there was a positive correlation between fat production and feed cost. The feed cost per pound of fat was lowered as the annual production of fat of the cow increased. This proportionate increase in feed cost was greater when the production of good cows doubled than when the production of poor cows doubled. The results also indicated that cows required a certain amount of feed for maintenance, above which the cost of each 100 lbs. of fat produced annually was practically the same whether the cow was a heavy or light producer. The high-producing cow was more profitable because the maintenance cost was spread over a larger quantity of product, rather than because of a more efficient use of feed.

Variability, accuracy, and adaptability of some common methods of determining the keeping quality of milk, I–V, A. H. Robertson et al. (*Vermont Sta. Buls. 314 (1930), pp. 46, figs. 12; 315 (1930), pp 39, figs. 24; 316 (1930), pp. 55, figs. 18; 317 (1930), pp. 154, figs. 70; 318 (1930), pp. 54, figs. 58*).—This study is in 5 parts.

I. *Methods of comparison*, A. H. Robertson and J. M. Frayer.—This outlines and discusses the advantages of certain methods of determining the bacterial content of milk. The conclusions in this phase are based on results obtained with 268 samples of milk analyzed by the reductase test and by actual agar plate counts.

The geometric mean was found to more nearly approach a satisfactory average than the arithmetic mean among bacterial counts obtained on the samples of milk examined. In these tests the period of observation extended between the initial bacteriological sampling and the time when the milk became unfit for use as a sweet milk beverage. The curve which represented the arithmetic or linear distribution of the observations was so far removed from the standard normal curve that calculations based on it appeared to be of small value.

Because of the long range of geometrically increasing plate counts and the relatively short range of lineally decreasing reduction times, the percentage variations and coefficients of variability betwen the highest and lowest counts in any series did not show relative variability and hence accuracy between the two methods. When used as an index of the keeping quality of milk, the observations suggested that the logarithmic values of plate counts were less variable in milk of low bacterial content, while the reduction times were less variable in milk of high bacterial content. One method appeared to be practically as accurate as the other over the entire range of keeping quality, and both were more accurate than the actual bacterial plate counts.

II. *Observations in sextuplicate*, A. H. Robertson, R. I. Moody, and J. M. Frayer.—This work is a continuation of studies previously reported (E. S. R., 57, p. 275) and supplements the two methods used in that work with both the individual and clump microscopic counts. As soon as each of the 152 samples tested arrived at the laboratory it was divided into six parts, and from these subsamples there were prepared in duplicate a series of agar plates, reductase tests, and milk smears for microscopic work. In addition to this, from the sixth sample five similar series were also prepared in duplicate.

The results showed that the reductase test was more variable than either of the other tests, especially when milk containing few bacteria was being tested.

The degree of relationship between the reductase test and the agar plate counts was greater than between the reductase test and the microscopic counts. The microscopic method as described and used in this work was not so accurate as the agar plate method, but a good technician should be able to obtain as accurate results with one method as with the other, provided a sufficient number of fields are examined. However, counting the considerable number of fields necessary for accuracy makes the method impractical, particularly when the milk being examined has a low bacterial content.

III. *Observations at different temperatures and at successive intervals on the same sample*, A. H. Robertson and J. M. Frayer.—Samples of milk were held at 50, 60, 70, and 80° F. until sour or otherwise unfit for beverage purposes. When the samples were received at the laboratory and usually at successive 2-hour periods after arrival, each sample was plated in triplicate, two microscopic preparations were made, two reductase tests were prepared, and the titratable acidity was determined.

It was found that determining the titratable acidity was an unsatisfactory way of estimating the keeping quality of milk, especially when the milk was of excellent or medium quality. Normal milk must usually contain more than 1,000,000 bacteria per cubic centimeter before any appreciable increase in titratable acidity can be detected. Tests depending on bacterial numbers were characterized in fresh milk containing few bacteria by a lag phase. During the lag and positive accelerative growth phases, more rapid changes took place in the milk as revealed by keeping quality than was evidenced by the corresponding increase in numbers of bacteria. This condition was regarded as a lack of sensitivity. The reductase test, on the other hand, often showed milk to be of much poorer quality than was really the case, a condition which was regarded as being too sensitive. The relatively few fields which were examined on the microscopic preparations indicated that these counts showed a greater lack of sensitivity among milk samples containing less than 100,000 bacteria per cubic centimeter than did the plate counts. The periods of sensitivity and lack of sensitivity were more extended as lower temperatures were used for holding the samples, the relationship between all tests being more consistent when the samples were held at from 70 to 80°.

The data obtained indicated that the mean time required for a 100 per cent increase in bacterial numbers at each respective temperature was 1 hour 30 minutes at 80°, 2 hours 25 minutes at 70°, 4 hours 10 minutes at 60°, 8 hours 13 minutes at 50°, and 39 hours 14 minutes at 40°. There was a high degree of similarity and a small amount of variability in the bacterial growth relations when calculated from the values obtained by each of the above methods.

The combined results indicate that the reductase and microscopic test can be used satisfactorily when rapid results are desired and that the agar plate count offers the most accurate and practical method of determining the bacterial content of milk containing relatively few bacteria.

IV. *Correlation studies*, A. H. Robertson and J. M. Frayer.—In these studies the data obtained indicated that the logarithms of the individual microscopic counts showed a closer relationship to the keeping quality of milk than the reductase test or the logarithms of either the clump count or the agar plate count. The reduction times were more closely related to the logarithms of the agar plate counts than to those of the microscopic counts. The agar plate counts when interpreted in terms of their logarithms, because they lend themselves more satisfactorily to straight-line relationship throughout the entire range and because the method is adaptable to milk containing few bacteria, offer a more accurate and practical method for estimating the keeping quality of milk than either the reductase test or the microscopic method.

While the use of logarithms lacked strict accuracy in all of its ramifications as applied to milk in which the lag or accelerative growth phase persisted, their use so well fitted the data that their practical application could not be ignored, especially when the observations were made at 70° and 80°.

For determining the method to be used the authors suggest that where it is necessary to know only whether the milk is good, medium, or poor the reductase test will furnish the information, but for determining the cause of poor milk the microscopic method is best suited. When premiums are paid for quality milk the agar plate counts furnish most reliable information.

V. *The broader aspects of variability*, A. H. Robertson and J. M. Frayer.—In this publication an attempt has been made to summarize the results reported in the previous bulletins relative to variability. The graphic presentation, using the logarithms of the actual bacterial counts, offered a clearer conception of the degree of variability and accuracy which could be expected among the bacterial counts and reduction times.

It is concluded that the agar plate method (logarithmic relations between the counts) is the most reliable method for use where premiums are paid for low-count milk and where control agencies are examining milk samples. The microscopic method and the reductase test should be used for rapid field work. The microscopic method has the added advantages that it can be used to determine fairly accurately the cause of high bacterial counts and that the preparations can be saved.

The calculated linear means, nonlinear means, and standard error limits for the reduction times corresponding to the agar plate counts among 4,670 observations are given in tabular form. In this table the reduction times less than one hour and all corresponding values were omitted.

The production of high quality milk.—II, The influence of delayed cooling upon the quality of milk, J. M. Frayer (*Vermont Sta. Bul., 313 (1930), pp. 34, figs. 17*).—Continuing this study (E. S. R., 62, p. 258), it was found that the prompt cooling of milk to 50° F. or less was necessary in order to obtain good quality milk which would keep well. The injury to the quality of the milk was roughly proportional to the length of time that elapsed before cooling. The injury to quality due to the failure to cool promptly is not always noticeable when the milk is received at the country plant, although the methylene blue test is apparently more sensitive to these differences in fresh milk than is the plate count.

Variations in the buffer value of herd milk, P. D. Watson (*Jour. Dairy Sci., 14 (1931), No. 1, pp. 50–58, figs. 4*).—In this study by the U. S. D. A. Bureau of Dairy Industry, it was found that the buffer capacity of Jersey milk was markedly greater than that of Holstein milk in the range of pH 5 to 6. Pasturing the herd had a negligible effect upon the buffer value of the milk.

The variations in buffer value which are likely to occur in a milk supply from day to day are presented in tabular form.

Variations in the coagulation and proteolysis of milk by Streptococcus lactis, L. A. Harriman and B. W. Hammer (*Jour. Dairy Sci., 14 (1931), No. 1, pp. 40–49*).—In studies with purified strains of *S. lactis*, it was found that certain strains which rapidly coagulated milk could be split into rapidly and slowly coagulating strains. The rapid strains produced considerable proteolysis in milk, while the slow strains produced little or no proteolysis.

In tests carried out with cultures secured by plating a slowly coagulating strain and picking colonies into litmus milk, all the cultures secured were slow in their coagulating rate. This indicated that it was more difficult to obtain rapidly coagulating cultures from slow strains than to obtain slowly coagulating cultures from rapid strains.

The variations in the rates of coagulation and the extent of proteolysis make these characteristics of little value in classifying *S. lactis*. The results also indicate that the marked differences in the coagulating rates of cultures secured from a plate poured with a dairy product do not necessarily indicate a difference in species.

Observations on the heat resistance of some ropy milk organisms, B. W. Hammer and R. V. Hussong (*Jour. Dairy Sci., 14 (1931), No. 1, pp. 27–39*).—Ropy milk organisms isolated at the Iowa Experiment Station from an outbreak of ropiness in pasteurized milk, from butter which showed ropy moisture droplets at the surface and which had been made from pasteurized cream, and from ropy whey obtained from pasteurized milk set for the manufacture of soft cheese were subjected to six heating trials involving a given temperature for various periods.

All of the organisms proved to be *Bacterium viscosum*, and in the heating trials none of the organisms survived 61.1° C. for 3 minutes. The exposed organisms had been added to milk after growing for varying periods in dilute milk or on agar slopes. Three cultures of *Aerobacter aerogenes* that produced ropiness in milk were also studied for heat resistance and were found to vary greatly in this character.

These results indicate that in some cases ropiness in pasteurized milk and milk products is due to contamination after the pasteurizing process.

Viability of Lactobacillus acidophilus and Lactobacillus bulgaricus cultures stored at various temperatures, L. A. Black (*Jour. Dairy Sci., 14 (1931), No. 1, pp. 59–72*).—Studies at the Washington Experiment Station showed that milk cultures of *L. acidophilus* could be stored at refrigerator temperatures for several days without causing any marked reduction in the number of living organisms. There was less reduction in numbers of organisms at 9° C. (48° F.) and at 0° than at 37°. The viability of the organisms of acidophilus milk kept for several days at either 9° or 22° was practically the same. The above results indicated that acidophilus milk could be stored for several days at the usual storage temperature of 4.4° or lower without affecting the number of viable organisms.

The reaction of various strains of the organism to different storage temperatures was similar, and the same was true of a strain of *L. bulgaricus* examined. Tests with an acidophilus commercial broth culture showed that refrigerator storage was preferable to storage at room temperatures. The stock cultures of *L. acidophilus* tested, whether old or recently isolated strains, remained viable when held in a refrigerator and transferred once in from 4 to 6 weeks or longer. A sealed tube of a recently isolated fecal strain was viable after one year's storage at refrigerator temperatures.

Some observations on the basic viscosity of ice cream mixes, J. C. Hening (*Jour. Dairy Sci., 14 (1931), No. 1, pp. 84–92*).—In this study at the New York State Experiment Station, two series of ice cream mixes, one containing butter, skim milk, skim milk powder, and sugar, and the other butter, skim milk powder, water, and sugar, were used to determine the effect of aging on their properties. The mixes also contained 0.56 per cent of gelatin. In the first series viscosity determinations were made on agitated and unagitated mixes. In the second series a proportion of the mix which had been homogenized at 2,000 lbs. pressure was run through the homogenizer four times at 200 lbs. pressure. A stirrer described by Whitaker (E. S. R., 61, p. 869) was used to agitate the mixes thoroughly.

The results showed that the method of agitation reduced the viscosity of the mixes by partially splitting the fat clumps, but the size of the clumps and

the viscosity were further reduced by running the mix through the homogenizer at low pressures. It was shown that different conditions of agitation may vary in their effectiveness in splitting fat clumps and introduce a variable factor in the magnitude of the basic viscosity secured. The basic viscosity, as now used, applies to a value secured under specific conditions and is not a correct minimum value.

Bromcresol green paper in the manufacture of grain-curd casein, E. O. Whittier (*Jour. Dairy Sci., 14 (1931), No. 1, p. 26*).—In this article from the U. S. D. A. Bureau of Dairy Industry a colorimetric method for testing the pH of grain-curd casein is described. The end point of precipitation is determined by the use of bromcresol green paper wet with whey and compared out of direct sunlight with dry paper standards. An error of not more than 0.1 pH unit has been consistently attained with the method.

Minutes of the sixteenth annual meeting, western division, American Dairy Science Association (*Amer. Dairy Sci. Assoc., West. Div., Minutes Ann. Meeting, 16 (1930), pp. [2]+94*).—The proceedings are given, in mimeographed form, of this meeting, held at Portland, Oreg., October 26 and 27, 1930 (E. S. R., 65, p. 65).

VETERINARY MEDICINE

General epidemiology of the infectious diseases of livestock, G. Francke and V. Goerttler (*Allgemeine Epidemiologie der Tierseuchen. Stuttgart: Ferdinand Enke, 1930, pp. VIII+278, figs. 19*).—This work considers the causative organisms of livestock diseases, susceptibility to infection, manner of transmission, local causes of outbreaks, influence of surroundings on the origin and spread, and veterinary police measures employed in outbreaks.

Studies in the biochemistry of micro-organisms, H. Raistrick et al. (*Roy. Soc. [London], Phil. Trans., Ser. B, 220 (1931), No. B 467, pp. IV+367, figs. 7*).—This is a report, in 18 parts, of studies in the biochemistry of microorganisms by Raistrick in collaboration with J. H. Birkinshaw, J. H. V. Charles, P. W. Clutterbuck, F. P. Coyne, A. C. Hetherington, C. H. Lilly, M. L. and W. Rintoul, R. Robinson, J. A. R. Stoyle, C. Thom, and W. Young. The work reported deals with the metabolic products of other families of the Eumycetes (true fungi) than the yeasts, popularly known as the molds. The species of the genera Aspergillus, Penicillium (including Citromyces), and Fusarium have been given particular attention.

A practical medical dictionary, T. L. Stedman (*New York: William Wood & Co., 1930, 11. ed., rev., pp. XI+1222, pls. 22, figs. 193*).—This revised edition of a work first issued in 1911 includes an appendix which gives a table of drugs—their doses and uses (pp. 1179–1197), weights and measures (pp. 1198–1202), symbols (p. 1202), stethoscopic abbreviations (p. 1203), comparative temperature scales (pp. 1204, 1205), comparative metric and English barometer scales (p. 1206), the chemical elements (p. 1207), and the important microparasites pathogenic for man and certain animals (pp. 1208–1222).

Animal pathology (*[Gt. Brit.] Min. Agr. and Fisheries, Rpts. Agr. Research Insts. [etc.], 1928–29, pp. 95–112*).—This is a report of work in (1) the Research Institute in Animal Pathology, Royal Veterinary College, London (pp. 97–99); (2) Department of Animal Pathology, Cambridge University (pp. 99–104); (3) Veterinary Laboratory, Ministry of Agriculture and Fisheries (pp. 105–108); (4) Animal Diseases Research Association of Scotland (pp. 108–111); (5) Milk Fever Investigations, Royal (Dick) Veterinary College and Hannah Dairy Research Institute (pp. 111, 112); and (6) Animal Diseases Division, Ministry of Agriculture, Northern Ireland (p. 112).

[Contributions on animal pathology] (*Arch. Wiss. u. Prakt. Tierheilk., 57 (1927), No. 1, pp. 112, figs. 28; 57 (1928), Nos. 2, pp. 113–212, pls. 4, figs. 29; 3, pp. 217–296, figs. 8; 4, pp. 299–415, figs. 11; 5, pp. 417–515, figs. 31; 6, pp. 521–603, figs. 12*).—The contributions here presented are as follows: Postmortem Findings in Diabetes Mellitus of the Dog and Cat, by A. Hjärre (pp. 1–76), including a bibliography of 67 titles; Individual Reactions (Isoagglutination, Isolysis, Hetero-agglutination, and Heterolysis) of the Blood of Normal Horses, by S. Schermer and O. Hofferber (pp. 77–99), including a bibliography of 41 titles; Epiphysial Fractures of the Femur in Young Dogs, by J. Carlin (pp. 100–104); Contribution on Chloral Hydrate Narcosis of the Horse, by K. Schouppe (pp. 105–109); Disinfection Experiments with Sulfoliquid D. S. in Fowl Pest, by R. Baumann (pp. 110–112); Upon the Present Outbreak of Hog Cholera, by O. Pröscholdt (pp. 113–139); On the Influence of Merck's Granulated Charcoal on the H-ion Concentration of Coli and Staphylococcus Cultures at Fever Heat, by H. Graf and H. Schrimpf (pp. 139–147); Indirect Ray Therapy of Rickets—I, The Principles of Indirect Ray Therapy: Ray Therapy and Vitamin Theory, by O. Schultz and G. Maurmann (pp. 148–163), including a list of 77 references to the literature; Registration of the Uterus Contractions of Bovines, by F. C. van der Kaay (pp. 164–204); Experimental Application of the Röntgen Ray in Actinomycosis and Some Other Diseases, by Schouppé (pp. 205–212); Further Investigations of Avian and Mammalian Pox, by E. Eberbeck (pp. 217–229); The Occurrence of Avian Tuberculosis in Swine; also a Contribution on the Cultivation of Tubercle Bacilli by Hohn's Method, by R. Helm (pp. 230–250), including a list of 83 references to the literature; Diagnostic Aids in the Detection of Pleuropneumonia of Cattle, by H. Dahmen (pp. 251–263); The Subacute Atrophy of the Liver, a Contribution on the Feeding of Cod-Liver Oil to Young Swine, by W. Bolle (pp. 264–272); Leptospira (*Spirochaeta ictero-uraemiae canis*) as the Cause of Jaundice, Nephritis, and Uremia in Dogs, by A. Klarenbeek (pp. 273–282); Indirect Ray Therapy of Rickets—II, The Valuation of Indirect Ray Therapy in Animal Investigation, by O. Schultz and G. Maurmann (pp. 283–296), including a list of 131 references to the literature; Contribution to the Active Immunization against Fowl Pox and Fowl Diphtheria, by R. Baumann (pp. 299–309), including a bibliography of 44 titles; The Therapy of Sterility in Cattle, with Particular Consideration of the Yatren-Vaccine-Therapy of Professor Oppermann, by F. Meyer (pp. 310–323); A Comparative Study of the Corium of the Hoof of the Horse and the Claw of the Bovine, by J. Bruhnke (pp. 324–334; Notes on Diagnosis of Colic of the Horse, by Neumann-Kleinpaul (pp. 335–342); Five Additional Operations for Traumatic Rupture of the Urinary Bladder of the Dog, by O. Überreiter (pp. 343–355); On the Reliability and the Practical Value of the So-Called Federisch Integer, by J. Bongert and Muchlinsky (pp. 356–396); Indirect Ray Therapy of Rickets—III, The Action of Indirect Ray Therapy, by O. Schultz and G. Maurmann (pp. 396–415), followed by a list of the literature arranged chronologically from 1922 to 1927, inclusive; Broncho- and Pneumono-mycosis of the Horse, by W. S. Tscherniak (pp. 417–444); Hematological Investigations of Infectious Anemia and Their Diagnostic Importance, by S. Schermer, R. Eigendorf, and R. Traupe (pp. 445–471); The Bacillary White Diarrhea of Chicks and Its Control—II, Serodiagnosis, by F. Schmidt-Hoensdorf (pp. 472–481); Investigations on the Posture of the Bones in the Horse, by W. Christnach (pp. 482–506); Quantitative Determinations of the Acetone in the Blood of Pregnant and Nonpregnant Cows, by A. Christaion (pp. 507–518); The Pathological Anatomy of Paratyphus of the Calf, by K. Nieberle (pp. 521–528); Some Investigations of the

Dissemination of Nosema Disease of the Honeybee (*Apis mellifera* L.), by H. H. Kittlausz (pp. 539–555); Investigations of the Alkali Reserve in the Blood of the Equine and Bovine, by F. Luchinetti and L. Neumayer (pp. 556–566); Investigations of the Residual Nitrogen Content of the Blood of the Equine and Bovine, by G. Skrkanek and K. Otter (pp. 567–574); On the Value of Lactertus Fibrosus and of Tendo Femorotarseus on the Posture and Movement of the Horse, by Strubelt (pp. 575–585); Arrhincephalia in Foals, by W. Baier (pp. 586–594); and Changes in the H-ion Concentration of Mixed Cultures of *Bacterium coli* and *Staphylococcus pyogenes* at Fever Heat Induced by Granulated Charcoal, by H. Graf and R. Ettrich (pp. 595–603).

[Studies in comparative pathology in Japan] (*Jour. Japan. Soc. Vet. Sci., 10 (1931), No. 1, pp. 1–30; 31–52, pls. 2*).—The contributions here presented (E. S. R., 64, p. 771) are as follows: Studies on Contagious Pleuropneumonia in Cattle—V, Further Observations regarding Lung Lesions, by S. Yamagiwa and H. Anbô (pp. 1–10; Eng. abs., pp. 9, 10); On the Specific Antibodies in the Serum of the Rabbit Infected by the Fixed Rabies Virus (pp. 11–19) and The Formolized Antirabic Vaccine (pp. 20–30; Fr. abs., p. 30), both by M. Watanabe; and Patho-histological Studies on the Characteristic Hemangiomata in the Scrotum of Swine, by D. Niimi (pp. 31–52; Eng. abs., pp. 50–52).

***Government of Northern Rhodesia, Department of Animal Health*, annual report for the year 1929**, J. Smith and R. A. S. Macdonald (*North. Rhodesia Dept. Anim. Health Ann. Rpt. 1929, pp. 27, pls. 6*).—This report (E. S. R., 62, p. 559) includes an account of the occurrence of and work with infectious diseases of livestock.

A review of plants poisonous to live-stock, H. R. Seddon (*Aust. and New Zeal. Assoc. Adv. Sci. Rpt., 20 (1930), pp. 409–428*).—This is a review of the present status of knowledge of poisonous plants in Australia as related to the effects manifested by them on animals, presented in connection with a list of 43 references to the literature.

An effective ascaricide—hexylresorcinol, P. D. Lamson, C. B. Ward, and H. W. Brown (*Soc. Expt. Biol. and Med. Proc., 27 (1930), No. 9, pp. 1017–1020*).—In a search made for a nontoxic ascaricide commenced in the laboratory several years previously, several active substances which might be of practical value were found. Among these hexylresorcinol seems most nearly to fulfill the necessary requirements of an ideal ascaricide.

Thermal death point, I–III (*Jour. Infect. Diseases, 48 (1931), No. 5, pp. 436–483*).—This report of studies consists of three parts.

I. *Spores of Clostridium tetani*, T. J. Murray and M. R. Headlee (pp. 436–456).—"Effective temperatures for the destruction of spores of *C. tetani* in physiologic solution of sodium chloride are 105, 100, and 95°C. At 105° the time varied between 5 and 10 minutes, at 100° between 10 and 25 minutes, and at 95° between 25 and 60 minutes. At 95° three strains resisted the 60-minute heating. Effective temperatures for dry spores heated in the absence of moisture with the six strains studied were 140, 135, 130, and 125°. At 140° the time varied from 5 to 15 minutes, at 135° from 5 to 25 minutes, and at 125° from 20 to 40 minutes. Dried spores heated under moist conditions showed no increased resistance, the effective temperatures being 105, 100, and 95°. In many of the strains drying decreased the thermal resistance. Drying of the spores of *C. tetani* on sand decreased the number of viable spores and also tended to decrease their resistance when heated under moist conditions. . . . Spores of *C. tetani* suspended in a solution of sodium chloride showed the greatest resistance to heat at a salt concentration of 2 per cent."

II. *Spores of Bacillus anthracis*, T. J. Murray (pp. 457–467).—"Effective temperatures for the destruction of the spores of *B. anthracis* in physiologic

solution of sodium chloride were 105, 100, 95, and 90°. At 105° the time varied from 5 to 10 minutes, the spores of most of the strains being destroyed in 5 minutes; at 100° from 5 to 10 minutes, most of the spores being destroyed in 10 minutes; at 95° from 10 to 25 minutes; and at 90° from 15 to 45 minutes. Effective temperatures for dry spores heated in the absence of moisture were 135, 130, 125, and 120°. At 135° the time varied from 5 to 10 minutes, at 130° it ranged from 15 to 20 minutes, at 125° it was 25 minutes, and at 120° it varied from 40 to 45 minutes. Dried spores heated under moist conditions showed no increased resistance, the effective temperatures being 100, 95, and 90°. . . . The resistance of spores of *B. anthracis* suspended in sodium chloride solution seemed to decrease with increase in the concentration of the salt."

III. *Spores of Clostridium welchii*, M. R. Headlee (pp. 468–483).—"The resistance of the spores of *C. welchii* in 0.85 per cent sodium chloride solution was found to be 30 minutes at 90°, 10 minutes at 95°, and 5 minutes or less at 100°. . . . Spores in solution of sodium chloride at increasing concentration of the salt to 4 per cent showed an optimum resistance at 3 per cent. At 10 per cent there was a definite decrease in resistance. Spores in peptone and gelatin solutions showed resistance inversely proportional to the concentration of organic substance, at pH 5, 7, and 10. In starch solution, an optimum resistance at 1 per cent starch was shown. Over a period of 2 months, spores changed little in thermal resistance when kept at ice box temperature for the latter half of the period. Dry spores were found more resistant to heat than wet spores. They had a resistance of 15 minutes at 130° and of 5 minutes or less at 140°."

Bibliographies of 21, 16, and 34 titles accompany parts 1, 2, and 3, respectively.

Vaccination against anthrax with the nonattenuated virus [trans. title], C. HRUSKA (*Compt. Rend. Acad. Sci. [Paris], 192 (1931), No. 13, pp. 822, 823*).—The author has found that a virulent anthrax virus when treated with a solution of saponin (saponinum purissimum album of Merck) gives a high protection against the disease. It is suggested that this method may be found of value in combating other infectious diseases.

Correlation of occupation with serologic reactions for Brucella abortus, A. THOMSEN (*Jour. Infect. Diseases, 48 (1931), No. 5, pp. 484–497*).—In the study reported 272 persons whose occupations brought them into contact with cattle were examined serologically for agglutinins and complement-fixing bodies for *B. abortus*.

It is concluded from the results obtained "that the treatment and care of sick animals infected with *B. abortus* are primarily responsible for the reactions noted in the persons observed and, presumably, for the infections. Flesh of killed animals, particularly newborn calves, would seem to be rather remotely connected, further study being indicated. Milk has no proved connection with the reactions. Since undulant fever rarely correlates with the titer of the serum, the usual strains of Brucella are presumably not pathogenic for men. Yet it is unequivocal that pathogenic strains do occur, and thus vaccination is indicated for those likely to be directly exposed. The interpretation of positive results in diagnostic serologic tests for Brucella among those in occupations connected with cattle or with Brucella should be made with care, since the serums of healthy persons thus employed may give positive reactions."

Metabolism studies on the Brucella group.—II, The fermentation of monosaccharides, C. E. ZOBELL and K. F. MEYER (*Soc. Expt. Biol. and Med.*

Proc., *28* (*1930*), *No. 2*, *pp. 160–162*).—The authors find that the fermentation of the monosaccharides can not be correlated in any way with the type of Brucella grouped either according to host origin, serologic tests, hydrogen sulfide production, or genesistatic behavior.

Coccidioidal granuloma: Occurrence in animals—reference to skin tests, M. D. Beck, J. Traum, and E. S. Harrington (*Jour. Amer. Vet. Med. Assoc.*, *78* (*1931*), *No. 4*, *pp. 490–499*, *figs. 2*).—This account is based upon studies conducted by the California Experiment Station in cooperation with the State Department of Public Health. Reporting upon 10 new cases, the authors call attention to the fact that cases of coccidioidal granuloma have been found in both man and animals. The fungus *Coccidioides immitis*, which possesses a double cycle, is the causative agent. "On artificial media it grows as a mold, and in tissue it appears as a double-contoured capsule. The lesions in animals have been confined to the bronchial and mediastinal lymph nodes. There is no evidence of animal to man transmission or vice versa. A specific allergic skin reaction has been obtained with coccidioidin in infected animals. A similar reaction has been observed in man. Some guinea pigs infected with coccidioidal granuloma give fairly good intradermal tuberculin reactions. This, however, is not constant."

Studies on infection by and resistance to the Preisz-Nocard bacillus.—I, The preparation and standardization of bacterial emulsions, L. B. Bull and C. G. Dickinson (*Aust. Jour. Expt. Biol. and Med. Sci.*, *8* (*1931*), *No. 1*, *pp. 45–52*).—This first contribution records observations made on the standardization of suspensions of the Preisz-Nocard bacillus, the causal organism of caseous lymphadenitis of sheep. It is believed that the methods evolved may be applied to other types of bacteria, but more particularly those possessing clump-forming potentialities.

The resistance and the blood sugar of animals infected with Trypanosoma evansi, M. A. Tubangui and L. M. Yutuc (*Philippine Jour. Sci.*, *45* (*1931*), *No. 1*, *pp. 93–107*, *figs. 7*).—It is concluded that in the majority of cases, irrespective of the kind of animal studied, no appreciable changes in the sugar content of the blood took place during the course of the infection, except at the very end when a terminal or agonal hypoglycemia was usually detected.

Susceptibility of the gopher (Citellus tridecemlineatus) to Mycobacterium tuberculosis, W. H. Feldman (*Amer. Jour. Path.*, *7* (*1931*), *No. 2*, *pp. 139–146*, *pls. 2*).—The author has found that "by experimental methods it is possible to induce lesions of tuberculosis in the striped gopher (*C. tridecemlineatus*) with each of the three bacillary forms of *M. tuberculosis*. The animals are more susceptible to organisms of bovine and human origin than to those derived from avian sources. The route of inoculation has a significant bearing on the induction of subsequent lesions, the intravenous route being the most effective."

The pathological changes following experimental exposure of dogs to Mycobacterium tuberculosis of avian origin, W. H. Feldman (*Amer. Jour. Path.*, *7* (*1931*), *No. 2*, *pp. 147–156*, *pls. 2*).—A report of a detailed histopathological study of dogs which had been infected with bacilli of avian tuberculosis. Infection was accomplished by injecting the organisms directly into the brain in six animals, and an occasional infection was obtained by the introduction of large numbers of the organisms intravenously in ten animals.

A modification of the medium of Sweany and Evanoff for culturing the organism of bovine tuberculosis, W. H. Feldman (*Jour. Amer. Vet. Med. Assoc.*, *78* (*1931*), *No. 4*, *pp. 527–530*).—The author describes a modification of the medium devised by Sweany and Evanoff (E. S. R., 62, p. 560) for the culti-

vation of the bovine form of *Mycobacterium tuberculosis*. This new medium is said to possess the merits of that made according to the original method and in addition is easier to prepare. The experimental data indicate the superiority of this medium over certain others for the isolation of the organism directly from infected foci of bovine tuberculosis.

Vaccination against tuberculosis with Bacillus Calmette-Guerin, A. C. RANKIN (*Canad. Jour. Research, 1 (1929), No. 1, pp. 48–85*).—This is a report of work with B. C. G. vaccine carried on in Alberta over a period of four years, during which time some 250 calves were employed.

"The vaccine was found to be entirely harmless, vaccinated calves developing normally and showing at autopsy no tuberculous lesions. Vaccinated animals in most cases reacted subsequently to the tuberculin test. Calves vaccinated with B. C. G. and immediately exposed to infection showed moderately increased resistance to tuberculosis over unvaccinated controls. Calves vaccinated with B. C. G. and subsequently kept under sanitary conditions for a period in order to permit resistance to develop before exposure to infection showed 80 per cent immunity as compared with 14 per cent for the controls. The tuberculous lesions found in vaccinated calves were in general much less pronounced as well as less numerous than those in unvaccinated animals."

The intradermal test as an aid in the diagnosis of undulant fever, W. LEVIN (*Jour. Lab. and Clin. Med., 16 (1930), No. 3, pp. 275–281*).—The author concludes that "the intradermal test for undulant fever holds promise of being of distinct diagnostic aid to the clinician and merits his serious consideration and study. In the absence of antiabortus agglutinins a positive intradermal test may be diagnostic of undulant fever; hence, the intradermal test should be performed on all individuals whose agglutination reactions are negative. If in suspected chronic cases of undulant fever both negative intradermal and agglutination tests are obtained, infection with *Br[ucella] abortus* may be safely ruled out."

The pathology of generalized vaccinia in rabbits, R. D. LILLIE and C. ARMSTRONG (*U. S. Pub. Health Serv., Natl. Inst. Health Bul. 156 (1930), pp. V+95, illus. 65*).—A detailed account is given of the pathologic histology of local and focal lesions of the skin, mucosae, and viscera of rabbits produced by Armstrong's heat selected vaccine virus. The literature relating to the histology of variola and vaccinia is reviewed in a six-page list of references.

The problem of rinderpest in India, J. T. EDWARDS (*Imp. Inst. Agr. Research, Pusa, Bul. 199 (1930), pp. [2]+16, pls. 21*).—The author concludes that means are now abundantly at hand for combating artificially outbreaks of rinderpest under the conditions in which they prevail in India.

Poisoning of sheep by the seeds of burrawang (Macrozamia spiralis), H. R. SEDDON and H. G. BELSCHNER (*Agr. Gaz. N. S. Wales, 41 (1930), No. 6, pp. 451–457, figs. 3*).—An account of the poisoning by seeds of burrawang, or Zamia palm, an ornamental plant common in coastal vegetation, which resulted in a very serious mortality of sheep in the Coonabarrabran district of New South Wales in May, 1929.

Responses of sheep to Zygadenus gramineus, "death camas," A. R. MCLAUGHLIN (*Science, 73 (1931), No. 1883, pp. 135, 136*).—The author reports that following the intravenous injection of an extract of death camas there occurred a respiratory inhibition which in the case of the injection of large amounts was followed by asphyxia-like rises of blood pressure. While from a field standpoint no satisfactory antidote has been found, it has been demonstrated that caffein sodio-benzoate possesses marked powers of stimulation for the respiratory center affected by the depressive substances occurring in this plant.

Some complications of sore mouth in lambs, I. E. NEWSOM and F. CROSS (*Jour. Amer. Vet. Med. Assoc., 78 (1931), No. 4, pp. 539–544, figs. 8*).—In this contribution from the Colorado Experiment Station, the authors report that while there may still be some question about the etiology of sore mouth there can seemingly be no doubt that the complications here described are due to the invasion of *Actinomyces necrophorus*.

Coccidial dysentery in Colorado feeder lambs in 1930, I. E. NEWSOM and F. CROSS (*Vet. Med., 26 (1931), No. 4, pp. 140–142, figs. 4*).—This is a contribution from the Colorado Experiment Station reporting upon observations of coccidiosis in lambs in continuation of those previously noted (E. S. R., 64, p. 74). Six additional lots of lambs showing coccidial dysentery are tabulated. A system of management is outlined which it is believed would be effective in handling an outbreak. Reasons are advanced for considering *Eimeria faurei* to be the causative organism.

On the differential diagnosis of the larvae of some helminth parasites of sheep and goats, D. O. MORGAN (*Jour. Helminthol., 8 (1930), No. 4, pp. 223–228, figs. 7*).—The author has found that through (1) an examination of the eggs occurring in the feces, (2) a Baermann extraction of the feces and an examination of the larvae thus obtained, and (3) an examination of the infective larvae obtained from cultures of the feces it is possible to determine the presence of most of the common species of helminths found in sheep and goats.

Intestinal adenoma in swine, H. E. BIESTER and L. H. SCHWARTE (*Amer. Jour. Path., 7 (1931), No. 2, pp. 175–185, pls. 3*).—This is a report of studies presented in connection with a list of 22 references to the literature.

Santonin as an anthelmintic for swine, H. MORRIS and J. A. MARTIN (*Jour. Amer. Vet. Med. Assoc., 78 (1931), No. 4, pp. 531–538*).—It is concluded from the experiments conducted at the Louisiana Experiment Stations that "santonin, if properly administered, is an effective anthelmintic for the removal of adult ascarids in swine. The value of santonin as an anthelmintic for immature ascarids should be given further study. Results indicate that the efficiency of santonin depends to a large extent not upon the amount given but upon the method of administration and purgation. Santonin and calomel, as recommended as an anthelmintic for swine, are ineffective, due to the lack of proper purgation. The combination of santonin and calomel, followed in a few hours by a saline purgative, proved to be highly efficient. Santonin alone, followed by a saline purgative, gives equal results. The results seem to indicate that santonin in large doses is nonirritating to the digestive tract."

Some further observations on dog distemper, G. W. DUNKIN and P. P. LAIDLAW (*Jour. Amer. Vet. Med. Assoc., 78 (1931), No. 4, pp. 545–551*).—In this contribution (E. S. R., 65, p. 472) the authors report upon the durability of the immunity following vaccine and virus administration and the conservation of virus.

[Report of work in avian pathology at the Rhode Island Station] (*Rhode Island Sta. Rpt. [1930], pp. 36, 37*).—In continuation of tests made of the action of certain chemicals as internal disinfectants (E. S. R., 63, p. 673), the fowl typhoid organism was employed as the infecting agent in place of *Salmonella pullorum* used in previous work. Baby chicks were inoculated, and the compounds metaphen and poly-comp were used in various dilutions as disinfectants. The results obtained indicate that the use of these disinfectants is of doubtful benefit in the control of fowl typhoid in baby chicks.

In studies made of the ability of *S. pullorum* to utilize citric acid as a sole source of carbon the results indicate that the majority of strains of this organism are able to attack citric acid. Experimental work is under way to deter-

mine the resistance of *S. pullorum* to chlorine in the presence of albumen as found in the eggshells from factories where eggs are used, such shells being fed to poultry as a source of nutrient lime. Evidence was obtained that the disease has been transmitted to healthy flocks through the feeding of such shells.

Brief references are made to a study of vaccines for fowl pox and to the longevity of coccidia in soils of different types.

A rare form of fowl cholera (wattle disease) [trans. title], J. CSONTOS (*Deut. Tierärztl. Wchnschr., 38 (1930), No. 27, pp. 417–421, figs. 5; abs. in Vet. Rec., 10 (1930), No. 44, p. 996*).—A report of a study made in Hungary in the autumn of 1929 of a wattle disease characterized by an edematous swelling caused by the fowl cholera bacillus. In 40 per cent of the 88 cases examined in 5 flocks, the fowl cholera bacillus could be isolated from the wattles.

A filtrable virus-like agent in avian laryngotracheitis, R. GRAHAM, F. THORP, JR., and W. A. JAMES (*Jour. Amer. Vet. Med. Assoc., 78 (1931), No. 4, pp. 506–517, figs. 7*).—In continuation of studies, accounts of which have been noted (E. S. R., 64, pp. 381, 382), the authors report upon inoculation experiments which represent selected tests with bacteriologically sterile filtrates over a period of 3 years.

"Bacteriologically sterile filtrates prepared from composite laryngeal exudates and body tissues of naturally infected fowls in two separate outbreaks of laryngotracheitis inconsistently produced subacute inflammatory changes in the larynx of healthy fowls. The infective nature of the filtrate-induced disease was demonstrated by repeated transfer to healthy fowls. The acute type of laryngotracheitis was not induced experimentally by sterile filtrates in intralaryngeal instillation, but symptoms approaching the acute malady were occasionally observed. The infective character of the unfiltered inoculum was demonstrated in susceptible fowls. The Mandler filtrates were less infective than the unfiltered inoculum, as judged by symptoms and gross lesions. The bacteriologically sterile filtrable virus-like agent in the laryngeal exudate of subacutely infected fowls remained viable at ice box temperature for periods of 30 and 60 days. The communicable character of the subacute disease in young chicks to mature fowls was demonstrated by direct laryngeal swabs."

Infectious laryngotracheitis in pheasants, G. KERNOHAN (*Jour. Amer. Vet. Med. Assoc., 78 (1931), No. 4, pp. 553–555, fig. 1*).—This is a brief report on an outbreak of disease among fowls and pheasants kept by a bird fancier in pens adjacent to pens containing ducks, domesticated mallards, peacocks, pigeons, doves, parakeets, canaries, and other species. The mortality among the diseased fowls was unusually high. Attempts, however, to transmit the disease from pheasants to fowls and pigeons were unsuccessful. Since normal pheasants were not available for testing, it was not determined whether the disease could be passed from pheasant to pheasant.

A study on Madras fowl pest, K. KYLASAMAIER (*Indian Vet. Jour., 7 (1931), No. 4, pp. 340–346, pls. 4*).—The author has found the virus in this disease to be ultramicroscopic, culture tubes inoculated with virulent materials having remained sterile. The period of incubation as observed varied from 24 hours to 5 days, and exceptionally over 5 days. "From the tests made so far it has been found that besides the saliva, alimentary contents, and heart blood, the tissues such as liver, spleen, and brain are highly infective. Liver and spleen and possibly brain tissue appear to be suitable material for vaccine. The results of cross tests with rinderpest virus would seem to suggest a relationship between rinderpest and the pest among fowls. As regards immunity following vaccination, it is premature to say how long the immunity lasts. It

would appear that at least 3 days must elapse after vaccination for birds to resist the infection."

A State-wide chicken pox control project, R. E. Jones (*Poultry Sci. Assoc. Proc., 22 (1930), pp. 26–29*).—An account is given of work under way in Connecticut, where in 1929 a total of 416,000 birds were vaccinated.

Comparison of the efficiency of the simplified method of Bunyea, Hall, and Dorset and the standard tube test for the identification of carriers of pullorum disease, W. L. Bleecker (*Jour. Amer. Vet. Med. Assoc., 78 (1931), No. 4, pp. 518–526*).—The author concludes that in the hands of an experienced operator the simplified agglutination test for the detection of carriers of pullorum disease is fully as efficient as the tube test when an interval of from three to five minutes is allowed before a diagnosis is made. The advantages over the tube test include the facts that it is entirely applicable to field use; only one drop of blood is required, so it has no bad effect on the fowl; testing can be done at any time during the year; very little glassware is required; cloudy precipitates do not interfere; and it is so easily applied that repeated tests can be made, making it possible to rid the flock entirely of carriers in the least possible time.

Spontaneous and experimental infection of pigeons with B. aertrycke, J. R. Cash and C. A. Doan (*Soc. Expt. Biol. and Med. Proc., 28 (1930), No. 3, pp. 235–238*).—The experiments here reported are offered as evidence of "the spontaneous development in undernourished pigeons of a fatal disease associated with marked myeloid hyperplasia of the bone marrow, striking increase of the myeloid elements of the blood, and extensive infiltration of the liver and kidneys with myeloid tissue; the cultivation of a bacillus from such pigeons which has been identified as *B[acillus] aertrycke;* the experimental production in pigeons of apparently the same disease and identical lesions by injection of liver emulsion of an infected bird or the oral administration of cultures of this organism; [and] bacteria-free filtrate of *B. aertrycke* produces no demonstrable effect when fed in large, single doses to normal pigeons."

Pokeweed berries not poisonous for chickens, J. M. Hendrickson and K. F. Hilbert (*Jour. Amer. Vet. Med. Assoc., 78 (1931), No. 4, pp. 556–558*).—The authors report that in feeding experiments ripe pokeweed berries did not cause any symptoms of poisoning or any ill effects when fed in large amounts over a period of approximately three weeks to five chickens and one duck.

AGRICULTURAL ENGINEERING

Opportunities for agricultural engineering research in the Southeastern States, R. W. Trullinger (*Agr. Engin., 12 (1931), No. 3, pp. 83–86, figs. 2*).—In a contribution from the U. S. D. A. Office of Experiment Stations, a brief review of the high points of the agricultural research active in the Southeastern States is given to indicate some of the outstanding opportunities for agricultural engineering research as a part thereof.

Preliminary report on the ground-water supply of Mimbres Valley, New Mexico, W. N. White (*U. S. Geol. Survey, Water-Supply Paper 637–B (1931), pp. II+69–90, pl. 1*).—This report, prepared in cooperation with the State engineer of New Mexico, relates to the supply of water that occurs below the surface of the Mimbres Valley in southwestern New Mexico.

The results indicate that the present irrigators in the Mimbres Valley are reasonably secure in their water supply provided no large additional pumping developments are made. The quantity of water stored in the underground reservoir is very large, but the annual recharge of this reservoir is relatively

small. It is considered unwise to formulate plans at this time for any large additional pumping development.

Water-power resources of the McKenzie River and its tributaries, Oregon, B. E. Jones and H. T. Stearns (*U. S. Geol. Survey, Water-Supply Paper 637-C (1931), pp. IV+91-124, pls. 8, figs. 4*).—The results of a study of the power resources of the McKenzie River and its tributaries are reported. The purpose was primarily to determine the probable use of the public lands in the basin in connection with the utilization of the power resources. The water power of the McKenzie River Basin is assumed to be capable of development at 34 sites, the potential power at which without storage is 290,000 h. p. for 90 per cent of the time and 444,000 h. p. for 50 per cent of the time. With storage at the four proposed reservoir sites the potential power for 90 per cent of the time is increased to 325,000 h. p.

Cost of pumping and duty of water for rice on the Grand Prairie of Arkansas, B. S. Clayton (*Arkansas Sta. Bul. 261 (1931), pp. 48, figs. 2*).—The results of a study, conducted by the U. S. D. A. Bureau of Public Roads in cooperation with the Arkansas Experiment Station, are reported in detail. A brief summary of these has been previously noted (E. S. R., 63, p. 177).

Influence of irrigation and drainage on farm machinery design and development, B. D. Moses (*Agr. Engin., 12 (1931), No. 4, pp. 117-119, figs. 6*).—In a contribution from the California Experiment Station, a brief review is presented on farm machinery design and development as it has been influenced by land reclamation practices such as drainage and irrigation.

Drainage and improvement of wet land, W. L. Powers (*Oregon Sta. Circ. 102 (1931), pp. 19, figs. 12*).—This is a revision of Circular 83 of the station (E. S. R., 57, p. 880). It gives practical information on the drainage and improvement of wet lands, particularly in western Oregon.

Studies of the rôle of forest vegetation in surficial run-off and soil erosion, W. C. Lowdermilk (*Agr. Engin., 12 (1931), No. 4, pp. 107-112, figs. 3*).—Studies conducted at the California Forest Experiment Station are reported, the purpose of which was to evaluate the factors affecting surficial run-off and erosion from forest soils.

The results indicate that natural vegetation with its layer of ground litter is the most effective agent in maintaining the maximum absorption rate of soils and similarly in maintaining the geologic norm of erosion.

Public Roads, [May, 1931] (*U. S. Dept. Agr., Public Roads, 12 (1931), No. 3, pp. 49-87+[2], figs. 23*).—This number of this periodical deals with the status of Federal-aid and emergency road construction as of April 30, 1931, data on gasoline taxes, 1930, and the following articles: An Investigation of Oil-Treated Earth Roads in Missouri, by F. V. Reagel, H. Aaron, and W. I. Watkins (pp. 49-63); and The Action of Sulphate Water on Concrete, by D. G. Miller and R. W. Manson (pp. 64-85).

Rural electric service in Nebraska, E. E. Brackett and E. B. Lewis (*Nebraska Sta. Bul. 254 (1931), pp. 23, figs. 15*).—Data are presented comparing farm line extensions in Nebraska during 1929 with those during 1927. The data for 1927 were presented in Bulletin 236 (E. S. R., 61, p. 879), which this bulletin supersedes.

It has been found that the total number of Nebraska farms receiving electric service from central station lines on January 1, 1930, was approximately 4,000. The period beginning with the latter part of 1927 and ending with the first few months of 1930 witnessed a greater increase in numbers thus served than any similar period in the history of the State.

Electric wiring for the farm, F. B. Wright and B. B. Robb (*N. Y. Agr. Col. (Cornell) Ext. Bul. 201 (1931), pp. 122, figs. 121*).—The purpose of this bulle-

tin is to present some of the modern ideas and practices in electric wiring, particularly as they may be applied to farm uses.

Wiring the farmstead, D. E. Blandy (*C. R. E. A. News Letter* [*Chicago*], *No. 11 (1931), pp. 30–42, figs. 13*).—Practical information on the subject is given.

The electric hotbed, M. W. Nixon (*C. R. E. A. News Letter* [*Chicago*], *No. 11 (1931), pp. 15–27, figs. 10*).—In a contribution from the New York Cornell Experiment Station, data from progressive experiments on the development and use of electric hotbeds are presented. The results indicate that a number of factors in the design, construction, and operation must be perfected before electric hotbeds reach any marked degree of satisfaction for practical use. Among these, insulation, heaters, sash, ventilation, covers, and carbon dioxide supply are considered of major importance. Mercury thermometers proved unsatisfactory for temperature regulation.

Advantages and disadvantages of electric brooders, J. E. Dougherty (*Agr. Engin., 12 (1931), No. 5, pp. 157–160, figs. 4*).—In a contribution from the California Experiment Station the problems relating to electric brooding are analyzed, with particular reference to design, construction, and operation.

The present status of machine milking, L. C. Prickett (*Agr. Engin., 12 (1931), No. 5, pp. 151–155, figs. 7*).—This is a contribution from the Committee on the Relation of Electricity to Agriculture and reports data summarizing the present status of mechanical milking.

The conclusion is that a herd of from 8 to 10 good cows will justify the purchase of a milking machine. Ordinary milking machines were found to save at least 50 per cent of the total milking labor in herds of from 20 to 25 cows, reducing the total cost of milk production by about 25 per cent. With a modified combine system and a rotary combine, the labor saved was found to amount to around 70 and 95 per cent, respectively. The energy consumption for ordinary pipe-line machines and portables should not exceed from 25 to 30 kw. hours and 15 kw. hours per month per 10 cows milked, respectively.

The suction method of washing was found to be fully as efficient as the brush-wash method. It is considered obvious that a modern installation is not complete unless it includes means for providing a supply of scalding water in the barn conveniently available immediately after milking.

A bibliography is included.

Mechanical tests on tractor farming equipment: A progress report, H. E. Murdock (*Montana Sta. Bul. 243 (1931), pp. 52, figs. 16*).—This is a progress report of these investigations. Part 1 is nontechnical, while part 2 presents the technical material. The results of mechanical tests on tractors and implements are summarized, and graphic and mathematical data are presented which deal with fuel consumption, draft, and fuel cost per acre.

The results show that the fuel consumption per horsepower hour is high when fuel consumption is high per acre. Fuel consumption per hour increases with the power developed, and fuel consumption per horsepower hour decreases with the power developed up to the optimum power. It was found that the optimum power for the tractors tested occurs near their drawbar rating.

Data are given on the horsepower required to pull different implements through the soil at a speed of 1 mile per hour. Tabular data are also given on the different implements and units thereof required to develop the optimum power of a tractor in high, intermediate, and low gear.

Studies showed that on a hilly farm tractors can not be operated so economically as on fairly level land, due partly to the impossibility of developing the rated load at all times. Not only is the effective drawbar pull of the tractor decreased when going up grade, but the pressure of the tractor wheels on the

ground is decreased, resulting in an increase in the slip which may become excessive before the tractor can develop its rated power. Tabular data are given showing the slopes necessary for the tractor alone to climb in the different gears to develop its rated drawbar horsepower.

In studies of tractor slip, it was found that by lessening the load a little and increasing the speed the power may be increased to the rating and the slip materially decreased.

The oil consumption also was found to affect the acre cost. It appeared that the same amount of oils and greases is used by a tractor whether developing full or part load. If this is the case, it is considered evident that the oil consumption per acre or per horsepower-hour will be increased proportionately to the decrease in the load.

The results indicate that slip may be the governing factor in limiting the load for tractors in cultivating summer fallow where the speed is so low that it requires a large drawbar pull to develop the rated power.

Corn production studies with the general-purpose tractors, R. U. Blasingame (*Agr. Engin., 12 (1931), No. 3, pp. 89, 90, figs. 2*).—The results of experiments conducted at the Pennsylvania Experiment Station are briefly summarized, indicating that an entire corn crop of 40 acres was produced with 6.65 man-hours per acre, using a 3-row general-purpose tractor.

The combination cushion spring and clutch release hitch, E. G. McKibben (*Agr. Engin., 12 (1931), No. 3, pp. 87, 88, figs. 4*).—The results of studies conducted at the Pennsylvania Experiment Station are reported, indicating the probability that a combination hitch consisting of a properly selected cushion spring and a well-designed clutch release will have worth-while possibilities for use with tillage implements in stony or obstructed soils. It is pointed out that the spring in such a hitch must have the proper stress-strain characteristics. The necessary characteristics for the overload clutch release are enumerated as durable and replaceable wearing parts, quick release without drag, accurate and convenient adjustment, reasonable first cost, and small effect of wear and exposure to dust and weather on adjustment.

Preliminary trials of a new type of mower, R. Bainer (*Agr. Engin., 12 (1931), No. 5, pp. 165, 166, figs. 5*).—Tests of a new type of mower are reported, which were conducted at the California Experiment Station. This machine is a power mower and crusher used as a means of accelerating the drying of alfalfa hay. No conclusions are drawn.

The artificial drying of hay, F. W. Duffee (*C. R. E. A. News Letter [Chicago], No. 11 (1931), pp. 3–15, figs. 14*).—In a contribution from the Wisconsin Experiment Station, a summary is given of data on experience from various sources on the artificial drying of hay, together with descriptions of different types of hay-drying equipment. A bibliography of 11 references is included.

A method of determining the volume and tonnage of haystacks, W. H. Hosterman (*U. S. Dept. Agr., Tech. Bul. 239 (1931), pp. 36, figs. 14*).—This bulletin contains information concerning the measurement of oblong stacks or ricks and of round stacks for the purpose of determining the volume and tonnage of hay therein without actually weighing the hay. It includes comparisons between the rules for determining volume in use at present and a set of new formulas developed from the data collected, as well as data on the number of cubic feet of hay required for a ton for various lengths of time from date of stacking to date of measuring. Formulas recommended for determining the volume of rectangular stacks are as follows:

For low, round-topped stacks $(0.52 \times O) - (0.44 \times W)\ WL$
For high, round-topped stacks $(0.52 \times O) - (0.46 \times W)\ WL$
For square, flat-topped stacks $(0.56 \times O) - (0.55 \times W)\ WL$

In these formulas W is the width, L the length, and O the over. A table is given for round stacks.

The study was conducted in cooperation with the California, Colorado, Idaho, Minnesota, Montana, Nebraska, Nevada, Oregon, South Dakota, and Utah Experiment Stations.

Tests on resistance to the passage of air through rough rice in a deep bin, E. J. Stirniman, G. P. Bodnar, and E. N. Bates (*Agr. Engin., 12 (1931), No. 5, pp. 145–148, figs. 8*).—Experiments conducted by the California Experiment Station in cooperation with the U. S. D. A. Bureau of Agricultural Economics are reported, the purpose of which was to determine the resistance to the passage of air offered by columns of rice of varying depths. The results are reported graphically. The law of the curves is of the form $Y=CX^n$, in which Y represents the volume of air in cubic feet per minute per square foot of cross section of the rice and X represents the thickness of the rice in feet, C being the coefficient.

Remodelling farm house cellars for the storage of potatoes, O. Butler (*New Hampshire Sta. Circ. 36 (1931), pp. 4, fig. 1*).—Practical information is given on the subject, with particular reference to the installation of insulating material. A table of the insulating values of different materials is included.

The 1931 modification of plans for the New Jersey multiple unit laying house, W. C. Thompson, L. M. Black, and E. R. Gross (*New Jersey Stas. Hints to Poultrymen, 19 (1931), No. 8, pp. 4, figs. 3*).—Information on the planning of this laying house is brought up to date.

Plans and list of materials for the New Jersey multiple unit laying house, 1931 modification, W. C. Thompson, L. M. Black, and E. R. Gross (*New Jersey Stas. Hints to Poultrymen, 19 (1931), No. 9, pp. 4, figs. 4*).—Working plans are presented, with a bill of materials.

Tests on hose for fighting rural fires, R. Bainer and K. R. Frost (*Agr. Engin., 12 (1931), No. 5, pp. 171, 172, figs. 3*).—Experiments conducted at the California Experiment Station are reported. These showed that 1-in. hose can be used satisfactorily with ⅛-in. nozzles for distances up to 1,000 ft. and ¼-in. nozzles up to 500 ft., while 1½-in. hose may be used with ⅜-in. nozzles for distances up to 1,000 ft. Friction was found to vary in fire hose very nearly as the square of the velocity. It was also found that the differences in pressure obtained when the hose is laid in various positions are not of material importance.

AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY

Rural economics, E. Laur (*Économie Rurale. Lausanne: Palot & Co., 1929, 2. ed., pp. 466*).—This is a manual for schools and farmers and has special application to small and medium size farming. The development of agriculture, the fundamental principles of economics, the factors in production—nature, labor, and capital, agricultural credit, acquisition of land, the organization and management of the farming enterprise, and the factors affecting marketing and prices of farm products are discussed.

Index numbers elucidated, W. I. King (*New York and London: Longmans, Green & Co., 1930, pp. XX+226, figs. 2*).—This book is designed for college students and others "who must use index numbers—the majority who do not have a mathematical turn of mind and who detest algebraic formulae." It discusses relative comparisons using complete data, the nature of index numbers, sampling as related to index numbers, index numbers derived from link relatives or ratios, types and averages as related to index numbers, per-

centages of error found in certain price indexes, and measuring the purchasing power of money.

Unification of methods of statistical analysis of agricultural records [trans. title], S. Moszczeński (*Vrtljh. Poln. Landw., 1 (1929), No. 1, pp. 35–57*).—This article in French has been previously noted (E. S. R., 62, p. 276).

Farm business records (*Rhode Island Sta. Rpt. [1930], pp. 29, 30*).—Brief summaries are made of the business records kept during 1929 on 142 farms.

An introduction to the theory of business administration for farming, E. Laur (*Einführung in die Wirtschaftslehre des Landbaus. Berlin: Paul Parey, 1930, 2. ed., rev., pp. XV+346, pl. 1*).—This is a revised edition of the volume previously noted (E. S. R., 47, p. 689). The section on agricultural labor has been expanded by the inclusion of findings since 1920.

Progress in development of the budgeting method of planning in agricultural economics, J. B. Hutson (*Washington, D. C.: [Author], 1930, pp. IV+158, figs. 16*).—This is a thesis submitted in partial fulfillment of the requirements for the degree of doctor of philosophy in the Faculty of Political Science of Columbia University. The points of view of research workers in farm organization, the nature of the farmer's problem, and the development of research in farm organization are described. The essentials of the budgeting method are discussed, and the method is illustrated by a study made of the system of farming in the Purchase Region of Kentucky (E. S. R., 62, p. 178.)

[Investigations in agricultural economics at the Vermont Station, 1929–30] (*Vermont Sta. Bul. 319 (1930), pp. 9–12*).—A study of farm organization and cost of milk production in the Charlotte-Ferrisburg-Panton area showed two striking relationships, in addition to the well-established ones between size of herds, efficiency in use of man labor, production per cow on the one hand and labor incomes or cost of milk production on the other. These were (1) that access to a grade A milk plant on the average doubled labor incomes, and (2) that labor incomes increased and milk production costs decreased roughly in proportion to the increment in the percentage of alfalfa and clover in the hay ration.

A study in 13 hill towns showed in 1929 a marked decrease from 1919 in the number of farms operated and marked increases both in the number of farms partially operated and the number of farms abandoned. The average labor income on 20 per cent of the farms was approximately $200. Only 1 operated farm in 8 had 60 to 75 acres of crop land, the amount deemed essential to produce a satisfactory living solely from farming.

An investigation of the effect on the composite price paid distant producers of the practice of granting price preferences to near-by producers of milk for the Boston market showed the average composite price paid in Vermont by the New England Milk Producers' Association would have been about 6 cts. per 100 lbs. higher if there had been no price preferences.

[Papers presented at the twenty-first annual meeting of the American Farm Economic Association] (*Jour. Farm Econ., 13 (1931), Nos. 1, pp. 1–154, figs. 2; 2, pp. 203–304, figs. 5*).—Included are the following papers, presented at the meeting held at Cleveland, Ohio, December 29–31, 1930:

No. 1.—Adjustment of Production in Agriculture, by V. Christgau (pp. 1–8); Farm Management Opportunities and Responsibilities, by H. C. M. Case (pp. 9–20); Social and Economic Aspects of Large-scale Farming in the Wheat Belt, by W. E. Grimes (pp. 21–26); Mechanization of Cotton Farms, by P. H. Stephens (pp. 27–36); What Agricultural Products Had We Best Export? by O. C. Stine (pp. 37–48); The Place of Farm Accounting in Research, by G. A. Pond (pp. 49–56); The Place of Farm Accounting in Extension, by C. R. Arnold

(pp. 57–64); The Farm Budget, by A. E. Anderson (pp. 65–70); Coordination of Farm Management Extension Programs, by V. B. Hart (pp. 71–86); Developments in Agricultural Economic Extension Work, by C. B. Smith (pp. 87–94); The Integration of Research and Extension for Progressive Agricultural Adjustments, by B. Youngblood (pp. 95–108); The 1930 Census of Agriculture—New Features and Uses, by F. F. Elliott (pp. 109–122); Functioning of the Federal Intermediate Credit Banks, by B. M. Gile (pp. 123–132); The Functioning of the Federal Land Banks, by R. C. Engberg (pp. 133–145); and Social and Economic Aspects of Large-scale Farming in the Corn-Belt, by A. G. Black (pp. 146–154).

No. 2.—The Outlook for Land Utilization in the United States, by O. E. Baker (pp. 203–230); National Land Policies in Retrospect and Prospect, by L. C. Gray (pp. 231–245); Reclamation Policies in the Pacific States, by D. Weeks (pp. 246–258); State Policies in Regulating Land Settlement Activities, by W. A. Hartman (pp. 259–269); A Social and Economic Program for Submarginal Agricultural Areas, by G. S. Wehrwein (pp. 270–279); and The New Agricultural Policy of Soviet Russia, by V. P. Timoshenko (pp. 280–304).

[Papers and discussions at the forty-third annual meeting of the American Economic Association] (*Amer. Econ. Rev., 21 (1931), No. 1, Sup., pp. 104–135*).—Included are papers presented by J. S. Davis on The Program of the Federal Farm Board (pp. 103–113) and by J. D. Black on Social Implications of the Restriction of Agricultural Output (pp. 114–124), and the discussions at the round table conferences on land economics at the meeting held at Cleveland, Ohio, December 29–31, 1930.

[Proceedings of the fourth annual meeting of the Western Farm Economics Association] (*West. Farm Econ. Assoc. Proc., 4 (1930), pp. [2]+162, figs. 7*).—Included are the following papers and discussions presented at the meeting held at Salt Lake City, Utah, June 10–14, 1930: Some Perspectives on the Value of Agricultural Cost Studies, by H. D. Scudder (pp. 1–5); Farming Readjustments in the Palouse Wheat District of Washington and Idaho, by P. A. Eke (pp. 6–17); Dry Land Wheat Farming in Wyoming, by H. Pearson (pp. 18–22); The Outlook for General Irrigated Farming as Power Farming Increases, by R. T. Burdick (pp. 23–26); Research in Local and National Outlook Work, by H. R. Tolley (pp. 27–31); Farm-Management Extension, by H. M. Dixon (pp. 32–43), discussion, by F. R. Wilcox (pp. 44, 45); The Use of Nomograph Charts in Dealing with Variables, by F. B. Headley (pp. 46–53); The Unappropriated Lands of the Western Range States, by A. F. Vass (pp. 54–96); Some Economic Aspects of the Washington Apple Industry, by C. C. Hampson (pp. 97–112); Policies and Plans under the Federal Agricultural Marketing Act, by L. Stuhr (pp. 113–122); The Regulation of Agricultural Production, by N. H. Comish (pp. 123–127); The Agricultural Marketing Act with Special Reference to How It Will Affect the Western States, by H. E. Erdman (pp. 128–138); Federal Farm Board Activities, by W. F. Schilling (pp. 138, 139); and The Farm Management Research Seminar, by H. R. Tolley et al. (pp. 140–147).

[Papers presented at the 1929 and 1930 conferences of the Agricultural Economics Society, Great Britain] (*Jour. Proc. Agr. Econ. Soc., 1 (1930), No 3, pp. 105, fig. 1*).—Included are a list of the members of the society and the following papers with discussions thereon presented at the meetings held at London, December 10 and 11, 1929, and at Oxford, June 27–30, 1930: A Programme of Research in Agricultural Economics, by J. S. King (pp. 9–24); The Study of Farm Labour in Germany, by J. M. Jones (pp. 25–38); The Application of Farm Management Data to Farm Practice in the United States

of America, by R. McG. Carslaw (pp. 37–51); The Economics of Rural Landowning, by W. C. D. Dampier-Whetham (pp. 56–75); A Word for Cost-Accounting, by J. Wyllie (pp. 76–90); Methods of Research in Agricultural Economics, by the Agricultural Economics Research Institute, Oxford (pp. 91–99); and The Aims of Research from the Farm Viewpoint (pp. 100, 101), and Farm Management Studies (pp. 102, 103), by E. J. Fawcett.

[Papers presented at the Fourteenth International Congress of Agriculture, Bucharest, June 7, 8, and 10, 1929] (*14. Congrès International d'Agriculture, Bucarest, 1929 Actes, vol. 2. Bucharest: Cultura Nationala, [1930?], pp. VIII+716, pls. 5, figs. 4*).—This is one of the volumes of the records of the congress, and includes papers in the sections on agricultural political economy, rural economics, and cooperation previously noted in preliminary form (E. S. R., 62, p. 276) and the following additional papers: Some Improvement That Should be Procured by Agrarian Reform in Central Europe, by A. Delos (pp. 33–37); Agrarian Reform in Greece, by P. Tzouliadis (pp. 73–79); The Labor Problem in Germany, Denmark, and Sweden in Raising Beets for Sugar, by the International Labor Bureau (pp. 513–527); Technical Means for Encouraging the Production and Propagation of New Improvements in Agriculture, by J. Jelinek (pp. 529–532); Cooperative Sale of Agricultural Products, by G. Berg (pp. 559–567); The Development and Character of the Cooperative Movement in Rumania, by A. G. Galan (pp. 625–660); and The Organization of Cooperatives in Rumania, by N. D. Kircoulesco (pp. 661–680).

Economic outlook for agriculture in the United States, G. F. Warren (*Sci. Agr., 11 (1931), No. 8, pp. 467–486, figs. 10*).—Production, especially of food and feed crops, prices (wholesale, retail, and farm), wages, costs of distribution, and world gold production during different periods from 1900 to 1930 are described, and comparisons are made with the periods of deflation following the Napoleonic wars in Europe and the War of 1812 and the Civil War in the United States.

As to future prices, the author states: "There may be some rise from the lowest point [since 1920], but I expect prices to decline below pre-war before many years." The primary remedy suggested for present conditions in agriculture is the reduction of the cost of production, particularly the cost of distribution, through discovery of methods requiring less hours of labor and ways of reducing costs of distribution, through increasing quality in the case of certain products to meet new demands from workers with high buying power, and, where efficiency can not be increased or distribution charges reduced rapidly enough, through reducing or holding stationary total food production while population grows.

Our farm problems and some possible solutions, W. Allen (*Sci. Agr., 11 (1931), No. 7, pp. 397–410, figs. 4*).—This is a paper presented at the Annual Convention of Saskatchewan Agricultural Societies, Saskatoon, January 14–16, 1931, and discusses the cost of production of wheat, farm indebtedness, farm prices of wheat, total farm receipts, farm expenses, and purchasing power of farm receipts over a period of years in Saskatchewan.

Summary of the main conclusions drawn from the experts' reports on the agricultural depression in the various countries (*Geneva: League of Nations, Econ. Com., 1930, pp. 20*).—This mimeographed draft enumerates some of the opinions as to the causes of the agricultural depression without attempting to pronounce on their merits or to formulate conclusions or make recommendations.

The world wheat situation, 1929–30: A review of the crop year, M. K. Bennett et al. (*Wheat Studies, Food Research Inst. [Stanford Univ.], 7*

(1930), No. 2, pp. [1]+89–184, figs. 38).—This is a continuation of the series previously noted (E. S. R., 62, p. 888), and reviews for the crop year 1929–30 the production of cereal crops and the consumption, stocks and carry-overs, and prices of wheat in different countries. It also discusses the international trade in wheat and the governmental measures adopted during the year affecting such trade and the operations in respect to wheat carried on in the United States under the Agricultural Marketing Act approved June 15, 1929.

The United States wheat flour export trade, A. E. Taylor (*Wheat Studies, Food Research Inst. [Stanford Univ.], 7 (1930), No. 1, pp. [1]+83+[4]*).—The purpose of this inquiry was to appraise the circumstances influencing the export of flour. Special attention is given to the technical considerations. Flour v. wheat in export and import policy, the flours of exporting and importing countries, the origins and destinations of flour exports from different countries, the international trade in flour, costs of milling and transportation, price parities in international trade, "improvement trade" in wheat, and the outlook for United States flour exports are discussed.

The solution of the cereals problem as a means of improving the position of agriculture, E. Laur (*Geneva: League of Nations, Econ. Com., 1930, pp. 19*).—The causes of the agricultural depression and methods of improving conditions, particularly as pertain to cereals, are discussed.

The essentials of a sound international agrarian policy are outlined as follows: (1) So long as prices of agricultural products on the world market are below the cost of production as a result of over-production and lack of selling organizations, industrial countries desirous of preserving their agriculture can not dispense with customs duties; (2) such duties can be reduced in proportion as imports are effected through monopolies or State-controlled import organizations and such organizations do not release foreign products at less than home cost of production; (3) cereal pools should be gradually extended in the exporting countries until they can control the whole of the production, especially the whole of the exports; (4) an international association of the pools of all countries should be formed to determine the quantities and to fix the prices of cereal exports; (5) means should be provided to enable the pools to dispose of surplus cereals, even at very low prices, without thereby bringing the world market price of bread cereals below cost of production; (6) every effort should be made to facilitate the advantageous employment of the other agricultural products; and (7) agricultural associations of the different countries should correlate with the International Institute of Agriculture in setting up offices to watch the market and advise regarding prices, and periodical meetings of the representatives of agriculture should be held to discuss the position of the market and the organization of sales.

The condition of production and marketing in the livestock and dairy industries of Germany, G. F. Warren et al. (*Die Erzeugungs- und Absatzverhältnisse der Deutschen Vieh- und Milchwirtschaft. Berlin: Paul Parey, 1929, pp. 150, figs. 4*).—This is the report of the American commission consisting of representatives from commercial organizations, State agricultural colleges and experiment stations, and the U. S. Department of Agriculture. The commission was organized at the request of leading agricultural organizations of Germany to investigate and make recommendations regarding the agricultural industry of that country, particularly the production and marketing of livestock and dairy products.

[Agrarian reform in central and eastern European countries] (*Internatl. Rev. Agr., Mo. Bul. Agr. Econ. and Sociol. [Rome], 20 (1929), Nos. 7, pp. 280–294, fig. 1; 8, pp. 319–333; 9, pp. 362–377; 10, pp. 406–413; 11, pp. 443–451; 12, pp. 477–481; 21 (1930), Nos. 5, pp. 157–174; 6, pp. 202–218, figs. 4; 8, pp.*

265–273).—This is a series of articles prepared by the ministries of agriculture of the several countries on the changes in the agrarian structure of their respective countries since the World War as follows: Lithuania, Finland, Latvia, Austria, Poland, and Czechoslovakia.

The agrarian reform.—I, Austria, Finland, Latvia, Lithuania, Poland (*Rome: Internatl. Inst. Agr., 1930, pt. 1, pp. 106, figs. 5*).—Included are the articles on agricultural reform since the World War and its results in Austria, Finland, Latvia, Lithuania, and Poland noted above.

Documentation relative to international agricultural credit, compiled by A. DE PÓKA-PIVNY (*Documentation Relative au Crédit Agricole International. Rome: Inst. Internatl. Agr., 1930, pp. XI+273*).—This is a collection of papers, reports, discussions, correspondence, etc., of the International Parliamentary Conference of Commerce, the International Congress of Agriculture, the League of Nations, and the International Institute of Agriculture and their committees and officers from 1925 to 1929, inclusive.

German agricultural credit, W. M. VON BISSING (*Der Realkredit der Deutschen Landwirtschaft. Berlin: Walter de Gruyter & Co., 1930, pp. 232, fig. 1*).—The pre-war condition and the effects of postwar inflation and stabilization of the monetary system on agricultural credit in Germany are discussed.

An inquiry into present-day value of capital invested in South Australian wheat farming, and its influence upon current costs of production, A. J. PERKINS (*So. Aust. Dept. Agr. Bul. 239 (1930), pp. 24, figs. 6*).—This report is based on data from the Turretfield Demonstration Farm and from 82 horse-worked and 47 tractor-worked wheat farms in different parts of South Australia. Tables show the utilization of land, capital investments by items, and interest and depreciation charges on the different types of farms and also on the farms grouped by size and districts.

The grade and staple of South Carolina's 1930 cotton crop, H. A. WHITE (*South Carolina Sta. Circ. 47 (1931), pp. 15, figs. 4*),—This circular, prepared in cooperation with the U. S. D. A. Bureau of Agricultural Economics, summarizes for popular use the results of the study previously noted (E. S. R., 65, p. 188) and sets forth facts to be considered in planning future cotton production.

Types of ranches and operating practices in relation to costs, investment, and income in the range beef cattle industry of Montana, M. H. SAUNDERSON and D. E. RICHARDS (*Montana Sta. Bul. 244 (1931), pp. 20, figs. 5*).—This is a preliminary report of a study made in cooperation with the U. S. D. A. Bureau of Agricultural Economics and the Montana Stock Growers Association. It presents a descriptive summary of the operating records for the year 1929 of 95 typical range cattle outfits. Tables are included showing, by items, the investment, indebtedness, costs, income, and the cost and income factors per head for the ranches grouped by natural operating conditions, by type of production, and by size of outfit. Other tables make comparisons of high and low income groups, purebred and beef outfits, and percentage of calf crop and costs and income, and show cost per calf under varying operating costs, the relation of size of outfit to costs and operator income, etc.

The study shows the following averages per head: Investment, exclusive of value of leased land, about $150; gross income, $27.35; operating cost, including wages of operator but not interest, $17.85; net income before payment of interest, $9.50; and interest, $3.20. Total operating costs were about the same for mountain, foothill, and prairie outfits. They averaged about $20 for outfits running a cow herd and selling calves, $18 to $20 for cow and yearling outfits, $16 to $18 for outfits selling 2-year-old steers, and $12 to $16 for outfits selling 3-year-old steers.

The cost of producing a calf was between $30 and $40, a yearling from $55 to $60, a 2-year-old steer $80 to $90, and a 3-year-old steer $100 to $115. Within limits, the income was found to increase with the amount put into operating costs. An 80 per cent calf crop was about the low cost point for producing a calf.

Gross income and the percentage of death loss were fairly closely related, outfits with death losses much above 5 per cent not being able to make any net returns. About 25 cows per bull on the average gave the best results as to bull costs and calf crop.

Operating costs per head tended to decrease up to 500 or 600 head and then to remain about constant. Gross income per head showed a marked tendency to increase up to 400 head and then to decrease as the size of outfit increased. Measured by return to operator and on investment, the most efficient size of outfit was found to lie between 300 and 800 head.

Survey of the poultry industry in New Zealand, E. J. FAWCETT (*Wellington: New Zeal. Dept. Agr., 1930, pp. 42, pls. 2, figs. 9*).—This survey was made to determine the present position of the industry and to study the factors affecting it detrimentally. The organization of the industry, production, consumption, export trade, prices, costs of production, and grading are discussed, and suggestions are made for stabilizing the industry and for a standard grading scheme.

East Anglian pig recording scheme, I, II, H. R. DAVIDSON and A. N. DUCKHAM (*Cambridge: Cambridge Univ., Anim. Nutrition Research Inst., 1929, Rpts. 1, pp. 3+48; 2, pp. 17, fig. 1*).—The first report outlines the aims and objects of pig recording, describes the methods used, and analyzes the records obtained from October 1, 1927, to April 1, 1929. The second report describes in detail and discusses the principles and methods of operation.

Economic aspects of pig recording [in East Anglia], A. W. M. KITCHIN (*Jour. Min. Agr. [Gt. Brit.], 37 (1931), No 10, pp. 957–965*).—The results through March, 1930, of the pig-recording scheme noted above and their economic aspects are discussed.

California: An index to the State sources of agricultural statistics.—Parts I, Fruits, vegetables, and nuts, Sect. 2; II, Crops other than fruits, vegetables, and nuts, compiled by L. O. BERCAW (*U. S. Dept. Agr., Bur. Agr. Econ., Agr. Econ. Bibliog. 31 (1930), pts. 1, sect. 2, pp. [2]+343–724; 2, pp. XLII+430*).—This is a continuation of the bibliography previously noted (E. S. R., 63, p. 689).

Special report of the State tax commission.—No. 2, Fiscal problems of rural decline, R. T. COMPTON (*Albany, N. Y.: State, 1929, pp. 283, pls. 4, figs. 12*).—This is a study of the methods of financing the costs of government in the economically decadent areas of New York. Part 1 (pp. 27–81) describes the present economic situation and the local government and fiscal system of the State. Part 2 (pp. 83–193) discusses the tax burdens, assessment and collections of taxes, education and highway finance, forest taxation, and other governmental functions in the State; describes conditions in Cayuga County, a fairly prosperous county with some very poor agricultural areas, in Chenango County, a typical poor county, and in the abandoned farm areas in Schuyler, Tompkins, and Steuben Counties; and examines some of the proposals for tax and government reform and the experiments being tried outside of New York, including the recommendations of the Governor's [New York] farm tax relief committee called together November 22, 1928, the 1929 New York legislative program, the distribution of State taxes, consolidation of governmental units and centralization of functions, and the directing of land utilization. Some comments are made on the taxation of utilities, the regressive and elastic nature of the property tax, the consolidation of governmental functions, the dangers of increased State aid, and the State land utilization policy.

Appendixes include a list of the decadent and declining towns in New York, appraisals of the relative merits of county and town assessments in other States by tax officials and other critics, the Wisconsin Rural Zoning Act of 1925, statistics used in the present study, and a bibliography.

Reconstruction of Virginia's tax system (*Richmond: Va. State Chamber Com., 1929, pp. 60, figs. 5*).—This is the report of the committee on taxation of the Virginia State Chamber of Commerce made in December, 1929. The revenue system of the State in 1925 and the revenues raised, the remedies proposed by the committee in 1925, and the changes in the taxing system made from 1925 to 1929, inclusive, and their effects on revenues are described, and suggestions are made for further improvements.

The farmers' national marketing system: Proceedings of the National Association of Marketing Officials (*Natl. Assoc. Marketing Off. Proc., 12 (1930), pp. 133*).—These proceedings of the twelfth annual meeting of the National Association of Marketing Officials, held at Chicago in December, 1930, include minutes, reports of committees, and the following papers or abstracts of papers presented at the meeting, with discussions: President's Address, by C. W. Wald (pp. 5, 6); Development of Auction-Block Systems of Selling Agricultural Commodities in New Jersey, by W. W. Oley (pp. 7–14); Keeping Up to Date on Marketing Research, by F. L. Thomsen (pp. 14–20); Making the Most Out of the Roadside Market, by C. E. Durst (pp. 20–26); Future Trading in Perishables and Semi-Perishables, by L. S. Tenny (pp. 27–30); Progress in the Work of the Federal Farm Board, by A. Legge (pp. 30–35); Team-Work Between the Bureau of Agricultural Economics and the Federal Farm Board, by N. A. Olsen (p. 35); Cooperation of Extension Workers in Work of the Federal Farm Board, by C. B. Smith (pp. 35–39); The Cooperation of Vocational Agricultural Workers in the Work of the Federal Farm Board, by C. H. Lane (pp. 40–44); Progress in Tobacco and Cotton Organization, by J. C. Stone (pp. 45–51); Marketing Work of the Farmers National Grain Corporation, by G. S. Milnor (pp. 51–54); Program of the National Live Stock Marketing Association, by J. D. Harper (pp. 54–58); The National Fruit and Vegetable Programs, by A. W. McKay (pp. 58–63); The World Wheat Situation, by O. C. Stine (pp. 63–67); The New Regional Grain-Marketing Organizations, by W. J. Kuhrt (pp. 67–73); The Colorado Potato-Growers Exchange, by W. F. Heppe (pp. 73–78); Frosted Packages of Fresh Meats, by F. M. Simpson (pp. 78–82); and The Perishable Agricultural Commodities Act in Operation, by C. W. Kitchen (pp. 82–87).

Direct marketing (*Boston: Mass. Dept. Agr., Div. Markets, 1930, pp. [2]+21+[4], figs. 2*).—This is a brief discussion of the principles of direct marketing, with illustrations of successful practices drawn from a survey made by the Massachusetts Department of Agriculture.

Is the public market a good civic investment? C. B. SHERMAN (*U. S. Dept. Agr. Leaflet 73 (1931), pp. 8, figs. 4*).—The conditions essential for the success of a public market are briefly described.

The law of cooperative marketing associations, J. HANNA (*New York: Ronald Press Co., 1931, pp. XXX+509*).—"This book aims to describe the nature and functions of agricultural cooperative marketing associations and to state the American law in respect to them." While primarily a law book, the author has kept in mind the problems of those connected and those doing business with cooperative associations and students of farm problems. Matters which are familiar elements of general corporation law, of contracts, and of equity jurisprudence are omitted. The development of cooperative marketing associations and the earlier State cooperative laws are described. Using the Bingham Cooperative Marketing Act adopted by Kentucky in 1922 as typical

of the standard cooperative marketing act, the several sections are analyzed, and it is shown wherein the several States have deviated from the standard act by adding, omitting, or varying sections. Comparison is made of the existing statutes in the several States. The legal and business phases of the organization, the operation, and the financing problems of cooperative marketing associations and of the marketing contract are discussed in detail.

Agriculture in New Jersey, C. R. Woodward (*New York: Amer. Hist. Soc., 1930, pp. 144, pls. 27, fig. 1*).—This is a reprint of the chapters on colonial agriculture and agriculture, 1775–1810, 1810–1860, and 1860–1930, from New Jersey—A History.

The basic industries and social history of Japan, 1914–1918, U. Kobayashi (*New Haven: Yale Univ. Press; London: Humphrey Milford, Oxford Univ. Press, 1930, pp. [13]+280*).—This publication of the Carnegie Endowment for International Peace deals with the economic and other changes brought about in Japan by the World War. The parts deal with agriculture, mining and metallurgy, forestry, the fisheries, the economic measures, and social effects.

[Report of the International Country Life Commission, 1930] (*Bul. Comn. Internatl. Embell. Vie Rurale [Bul. Internatl. Country Life Comn.], No. 9 (1930), pp. 419*).—This publication includes a brief history of the commission, information for members, and communications and reports presented at the fourth congress, held at Liége August 7–15, 1930.

AGRICULTURAL AND HOME ECONOMICS EDUCATION

The elements of live stock judging, W. W. Smith (*Philadelphia and London: J. B. Lippincott Co., 1930, 2. ed., rev., pp. [VII]+151, figs. 82*).—This is a revised edition of the text previously noted (E. S. R., 58, p. 688).

Dramatics for farm folks, D. E. Lindstrom (*Illinois Sta. Circ. 373 (1931), pp. 16, figs. 12*).—This is a manual for the use of rural groups desiring to present one-act plays.

FOODS—HUMAN NUTRITION

The effect of cooking on the digestibility of meat, W. M. Clifford (*Biochem. Jour., 24 (1930), No. 6, pp. 1728–1733, fig. 1*).—Artificial digestion experiments with trypsin and pepsin and with trypsin alone are reported for raw beef and beef roasted, grilled, and boiled to an underdone and overdone stage. The meat used for boiling was ground before being cooked and in the other cases after being cooked.

No appreciable difference was noted in the rate of digestion with trypsin alone or with pepsin followed by trypsin. Taking the rapidity of hydrolysis as a criterion, the raw meat proved to be the least digestible and the underdone the most digestible, with the well-done intermediate between the two. The least rapidly digested form of the cooked meat was the overboiled ground sample and the most rapidly the underdone roast. When the underdone meat was reheated without overcooking, its digestion rate was unaltered, but if overcooked on reheating, the rate of digestion was diminished.

It is concluded that for people with weak digestive powers or for young children the ideal form in which to give meat is as underdone roast minced or ground after cooking.

The biological values of proteins, I, II, (*Biochem. Jour., 24 (1930), No. 6, pp. 1780–1782, 1794–1804, fig. 1*).—Two papers are presented.

I. *A method for measuring the nitrogenous exchange of rats for the purpose of determining the biological value of proteins,* H. Chick and M. H. Roscoe.—

The method described consists in determining the average daily nitrogen balance of 2 adult male rats during a period of 4 or 5 days on a diet containing a definite proportion of the protein under investigation.

Precautions are outlined for the control of intake and output of nitrogen, and data are reported indicating the reliability of the method as far as risk of nitrogen loss is concerned. In estimating the biological value of the protein, "it is necessary to determine the minimum amount of nitrogen (M) (derived from the given protein as sole source of nitrogen in the diet) which must be absorbed to compensate the daily nitrogenous expenditure (E) on a nitrogen-free diet. The latter is determined for the same pair of rats, being the total nitrogen excreted in feces and urine on a protein-free diet consisting of fat and carbohydrate only. The biological value of protein P can then be defined as $100\times\frac{E}{M}$."

The principal technical difficulty is thought to lie in the determination of E, on account of the frequent difficulty through loss of appetite in securing a sufficiently high caloric intake to prevent loss in weight. Another complication is the difficulty in providing for the B vitamins without increasing the nitrogen content of the diet. By the use of purified concentrates from yeast, this difficulty is largely avoided.

II. *The biological value of purified caseinogen and the influence of vitamin B_2 upon biological values, determined by the balance sheet method*, M. A. B. Fixsen.—Using the method described in the first paper, the author has redetermined the biological values of purified casein at different levels of intake and in the presence or absence of vitamin B_2 by 12 metabolism experiments on adult male rats. It was the original purpose to determine the possible influence of vitamins B_1 and B_2 on nitrogen metabolism by conducting the experiments in the presence and absence of each of these vitamins. In the absence of vitamin B_1, however, decline in appetite was so rapid that it was impossible to secure a high enough intake of food to give satisfactory results. In the absence of vitamin B_2 there was also a loss in appetite and a decrease in food consumption, and some of the experiments in this series had to be discarded.

The biological value as calculated from the formula $B.\ V.=100\ (1-\tan\ \theta)$, the verification of which is explained, was found to be 45, a figure considerably lower than that reported by previous workers. The absence of vitamin B_2 from the diet appeared to have no effect upon the economical use of the ingested protein, nor was there any evidence of variation in biological value at different levels of intake or of the existence of different biological values for growth and maintenance.

The vitamins, H. C. SHERMAN and S. L. SMITH (*New York: Chem. Catalog Co., 1931, 2. ed., pp. 575, [pls. 3], figs. [9]*).—In the nine years which have elapsed since the publication of the first edition of this monograph (E. S. R., 46, p. 863), the number of definitely recognized vitamins has doubled, marked improvements have taken place in the technic for their quantitative determinations, and considerably more is known about their chemical and physiological behavior. All this is reflected in the present revision. In spite of the omission of the general chapter on vitamins and the problem of food supply, the lists of reported occurrence of the vitamins, and the table of qualitative distribution, the text is considerably longer than the first edition and the bibliography alone occupies 183 pages.

Following a general introductory chapter, the individual vitamins are discussed in separate chapters in the order of the water-soluble vitamins B (B_1), G (B_2), and C, and the fat-soluble vitamins A, D, and E. Although there has been no attempt at uniformity of treatment in the various chapters, each sum-

marizes present knowledge concerning the chemical nature of the vitamin in question, its rôle in life processes, formation and distribution in nature, relative abundance in different food materials, and stability under the conditions in which it is most likely to be subjected in food materials. Of particular value to laboratory workers are the detailed descriptions of the methods for the quantitative determination of the various vitamins as developed in the senior author's laboratory.

The bibliography, as well as the text, has been thoroughly indexed, thus making the subject index a key not only to the text itself, but to the extensive literature on the subject not included in the specific citations in the text.

The determination of vitamin A, K. H. Coward, K. M. Key, F. J. Dyer, and B. G. E. Morgan (*Biochem. Jour., 24 (1930), No. 6, pp. 1952–1966, figs. 9*).—"A method is described by which the vitamin A content of two substances may be compared, using two groups of rats, there being 5 or preferably 10 rats in each group. Each group of rats is fed on vitamin A-free diet until growth ceases, and each rat within the group is then given the same daily dose of the substance to be tested. The mean increases in weight of the two groups are calculated. These mean increases are then referred to a curve which relates mean increase to dose of a particular sample of cod-liver oil. The relative potency of the two substances is calculated from the doses of cod-liver oil corresponding to the mean increases of the groups used in testing these substances. When 10 rats are used in a group, the potency of a substance can usually be estimated with an error of less than 30 per cent."

In discussing the method and the experimental data upon which it is based, the authors emphasize again their inability to obtain uniform results in vitamin A feeding experiments in which Glaxo "vitamin-free casein" is used (E. S. R., 63, p. 193). They point out that the curve which they have developed, relating dose to mean increase of weight in a group, can not be assumed to be applicable to all vitamin A-free diets.

Another point to which attention is drawn is the demonstration that a relation exists between the size of the dose administered to a group and the percentage of animals dying in the period from the second to the fifth week of the administration of the test material. It was found that when rats ceased to grow on a vitamin A-free diet, the addition of small daily doses of cod-liver oil did not prevent some of the rats from dying during the next 5 weeks and that with increasing amounts of the cod-liver oil the proportion of rats which died diminished and of those which resumed growth increased. The rats which died all showed on post-mortem examination abscesses such as described by Green and Mellanby (E. S. R., 60, p. 791). The authors believe that these results indicate a very close relationship between the growth-promoting and antiinfective power of vitamin A. "Thus the first effect of the addition of the smallest doses of cod-liver oil to groups of rats may be described as the antiinfective effect by which the proportion which die in 5 weeks is steadily reduced. We see that as the dose increases this effect passes, by insensible gradations, into the growth-promoting action, and we conclude that, for purposes of measurement at any rate, the antiinfective property and the growth-promoting property are merely different aspects of the same thing."

Attention is finally called to the conclusion of Irwin, Brandt, and Nelson (E. S. R., 64, p. 585) that the total food eaten has by far the greatest influence on the gain in weight of the animals and that some technic for the regulation of the food intake of the animals would lead to less variability in response. "We have not made records of the daily intake of basal diet in these experiments, but it would appear to be unnecessary for our purpose to do so, as we

have obtained comparable results on small numbers of animals without considering this factor."

"Diet 4" for breeding rats for work on vitamin A, S. V. Gudjónsson (*Biochem. Jour., 24 (1930), No. 6, pp. 1591–1594, figs. 6*).—A further study is reported of the breeding diet for vitamin A experiments developed by the author (E. S. R., 63, p. 493). The diet consisted of skim milk powder 30, rice flour 40, autolyzed yeast 15, and hardened coconut oil and shark-liver oil 15 per cent. The skim milk powder was made from pasteurized milk containing only about 1 per cent of fat and the rice flour from polished rice. The yeast was a top yeast autolyzed at 40° C. and used without drying, and the coconut oil contained 0.3 per cent of shark-liver oil. On this diet the rats are said to breed well and produce young of very uniform quality with a minimum storage of vitamin A.

Monthly data for a period of a year are summarized graphically on the number of litters and the number of young per 100 females, the size of the litters and weights of the individual young at 30 days, the average length of the preliminary depletion period, and the average weight variations during this period. All of these curves show only slight seasonal variations. The average length of the depletion period was 4.4 weeks and the greatest length 7.5 weeks. The increases in weight during the depletion period were not very different, but there appeared to be a tendency to greater increases in weight during the months of August to January than in the spring and early summer months. The uniformity of stock on this breeding diet is such that the possibility is suggested of doing away entirely with the depletion period and placing the rats on the experimental diet at the age of 30 days.

Vitamin-B and vitamin-G content of cereals, R. A. Hetler, C. R. Meyer, and D. Hussemann (*Illinois Sta. Bul. 369 (1931), pp. 165–211, figs. 16*).—This bulletin contains the complete report, with experimental data, of studies carried on during the years 1927 to 1930 and noted previously from progress reports. The first of these, completed before the differentiation of vitamins B and G, was concerned with the content of the vitamin B complex in the embryo and endosperm ends of hand-dissected oat kernels (E. S. R., 60, p. 294). This was followed by studies of the vitamin B (B_1) value of whole hull-less oats, whole hulled oats, oat products, whole yellow corn, and whole wheat, using autoclaved yeast as the source of vitamin G, and the vitamin G (B_2) content of whole hull-less oats, whole yellow corn, whole winter wheat, and rice polishings, using tikitiki as the source of vitamin B_1 (E. S. R., 64, p. 895). In most of the vitamin B_1 experiments, the basal diet included cornstarch and Crisco as the chief sources of energy other than the cereals to be tested. When glucose was substituted for these, with no fat other than the cod-liver oil necessary to furnish vitamins A and D, a somewhat higher level of any of the cereals was necessary to furnish enough vitamin B_1 for good growth. In the vitamin B_2 tests the glucose ration was used throughout.

The final series of studies reported dealt with the vitamin B (B_1) and G (B_2) value of whole hull-less oats for lactation (E. S. R., 64, p. 895). In these studies the cornstarch basal diet was used.

The results obtained indicate in general that the inclusion of 25 per cent of oats, corn, or wheat in the diet probably provides an adequate supply of vitamin B for growth if plenty of vitamin G is incorporated in the basal diet, but if the cereal is to furnish both vitamins B and G in abundance it must constitute at least 50 per cent of the diet. To meet the requirements of successful lactation at least 50 per cent of oats was necessary to furnish sufficient vitamin B. The largest amount of oats that could be fed without altering the proportion of protein and salts (72 per cent) did not provide sufficient vitamin G for lacta-

tion. The addition of 15 per cent autoclaved yeast to the diet containing 50 per cent of oats rendered it satisfactory for lactation.

In commenting upon the relative amounts of the cereals required for meeting the B and G requirements of rats, the authors state "it thus appears that vitamin G is the limiting factor of the 'vitamin-B complex' of cereals. Whether there is a real difference in the content of vitamins B and G in the cereals, or whether the relative amounts of vitamins B and G needed by the rat differ, is a subject for further investigation. It is very possible that an interrelationship exists in the needs of the rat for these two vitamins, and thus that we are testing this factor rather than the content of the vitamins in the cereals and cereal products."

The distribution of the vitamin B complex.—I, Leafy vegetables, M. H. Roscoe (*Biochem. Jour.*, *24* (*1930*), *No. 6, pp. 1754–1763*).—The author has extended the investigation begun by Aykroyd and Roscoe (E. S. R., 62, p. 194) of the distribution of vitamins B_1 and B_2 (G) in foodstuffs to water cress, lettuce, cabbage, spinach, and onion. The methods followed were those of Chick and Roscoe (E. S. R., 60, p. 690; 62, p. 195), with slight modifications. In the vitamin B_1 studies, the estimations were made in duplicate, using in one case egg white as the source of protein and vitamin B_2 and in the other casein for protein and autoclaved yeast extract for vitamin B_2. For the most part dried samples were used. These were prepared by plunging the leaves, previously washed and freed of stalks and midribs, in boiling water for a minute, spreading on sheets of paper, drying at 37° C. for 48 hours, and grinding to a fine powder in a coffee mill.

In the B_1 tests, the smallest amount of water cress tested, 0.3 gm. daily of the dried material, promoted growth in excess of the standard 50 to 60 gm. in 5 weeks. Lettuce ranked next, the rats receiving 0.3 gm. daily gaining 53 gm. in the 5 weeks. This was followed by cabbage, the white leaves of which appeared to be slightly richer in vitamin B_1 than the green, since the average gains on 0.3 gm. daily were 43 and 33 gm. for the white and green leaves, respectively. Spinach ranked next. The amount fed, 0.5 gm. daily, caused an average gain of 58 gm. in the 5 weeks as compared with 69 gm. for the same weight of white cabbage. Onions had the lowest content of vitamin B_1, the rats receiving 1 gm. gaining 56 gm., the same gain as those receiving half as much spinach.

In comparison with other food materials on a dry basis, these leafy vegetables are considered to be from one-fourth to one-half as rich in vitamin B_1 as yeast, wheat germ, or ox liver, nearly twice as rich as egg yolk, and from two to three times as rich as ox muscle. Slight differences in the rate of growth on the two basal diets with the same amounts of the materials as the source of vitamin B_1 are thought to suggest the presence in autoclaved yeast but not in egg white of a new dietary factor provisionally called factor Y. This is thought to be provided in adequate amounts in water cress, dark green cabbage leaves, and spinach, in smaller amounts in lettuce and etiolated cabbage leaves, and in much smaller amounts in onions.

In content of vitamin B_2, water cress, spinach, and the dark green leaves of cabbage were richest, followed by lettuce, with onions again the lowest. On 0.5 gm. of the dried material the average gains in 5 weeks were 56 gm. in the case of water cress, 58 for dark green cabbage, and 54 for spinach. Lettuce was not fed at this level, but on 0.6 gm. the gain was practically the same, 57 gm. On 0.2 gm. daily the gains were for water cress 53, lettuce 44, and green cabbage and spinach 41 gm. The white leaves of cabbage caused a gain of 34 gm. in amounts of 0.2 gm. daily and of 36 gm. in amounts of 0.4 gm. On 0.8 gm. of onion the gain was only 21 mg. In comparison with other foods,

the green vegetables were from one-eighth to one-half as rich as dried yeast, about equal to milk, steak, and egg yolk, and considerably richer than cereals and pulses.

In the vitamin B_2 experiments, the materials richest in growth-promoting power had also the strongest curative action for dermatitis, but less was needed for this than for growth.

A study was made of the effect of cooking on the content of vitamin B_1 and B_2 in spinach. The spinach was boiled for 15 minutes with a small amount of water, the juice drained off, and the tests made with the solid and juice portions. On equivalent amounts of the dried cooked spinach and juice as sources of vitamin B_1, similar gains were obtained, but with the same materials as sources of vitamin B_2 greater gains were made on the juice than on the solid. It was concluded that about half of the vitamin B_1 and possibly more than half of B_2 had passed into the juice.

Egg-white as a source of the antidermatitis vitamin B_2, H. Chick, A. M. Copping, and M. H. Roscoe (*Biochem. Jour., 24 (1930), No. 6, pp. 1748–1753*).—The evidence upon which was based the statement by Chick and Roscoe (E. S. R., 62, p. 195) that egg white contains vitamin B_2, unaccompanied by the antineuritic vitamin B_1, is summarized briefly.

A daily dose of from 2.5 to 5 gm. of fresh cooked egg white (dry weight from 0.3 to 0.6 gm.) proved capable of restoring growth at a rate of from 10 to 12 gm. a week in rats on the vitamin B_2-deficient diet of Chick and Roscoe (E. S. R., 60, p. 690). Compared with the results reported by Aykroyd and Roscoe (E. S. R., 62, p. 194) for the vitamin B_2 content of various food materials, egg white is among the foods richer in vitamin B_2, being of about equal value with milk and meat on the dry basis, though inferior to liver and yeast.

Furthermore, convincing evidence of the richness of egg white in vitamin B_2 was obtained in the rapid cure of the characteristic lesions which develop in rats on diets deficient in vitamin B_2, as described by Chick and Copping (E. S. R., 64, p. 589), by administration of the fresh egg white or a concentrate prepared from it by the removal of the heat-coagulable proteins. The technic for the preparation of the concentrate is essentially as follows:

Fresh egg white is diluted with 3.5 times its weight of distilled water, and sulfuric acid is added until the pH is 4.2, as determined with bromocresol green as an indicator. The mixture is heated to the boiling point, boiled with stirring for about 5 minutes, filtered with slight suction, and the precipitate pressed in a hand press. The filtrate and press liquor are combined and evaporated at 37° C. and afterwards on a water bath at 100°, until 1 cc. contains the equivalent of from 4 to 5 gm. of the egg white. The sulfates present are then removed by barium chloride, care being taken to make the removal slightly incomplete in order that no barium be left in the final material. The filtrate is finally concentrated until 1 cc. contains the equivalent of 5 gm. of egg white and the pH is adjusted to about 3 for storage. In most cases doses of the concentrate equivalent to from 5 to 10 gm. of the fresh egg white cured skin lesions in about 3 weeks and brought about temporary restoration of growth.

Attempts to purify such concentrates still further by alcohol fractionation or precipitation with lead acetate were unsuccessful.

In attempts to determine the agency which prevents the diffusion of vitamin B_1 from the yolk into the white, undiluted egg yolk was placed in a cellophane membrane surrounded by distilled water and left for 4 days at about 0°. At the end of this time vitamin B_1 was found in the surrounding fluid. "It is

probable that the diffusion of vitamin B_1 in the egg from the yolk to the white is prevented by some property of the living yolk membrane."

The composite nature of the water-soluble vitamin B.—III, Dietary factors in addition to the antineuritic vitamin B_1 and the antidermatitis vitamin B_2, H. Chick and A. M. Copping (*Biochem. Jour., 24 (1930), No. 6, pp. 1764–1779, fig. 1*).—In this continuation of the series of papers noted previously (E. S. R., 60, p. 690), evidence along various lines is presented, indicating the presence in yeast of a new water-soluble dietary factor essential for the growth and nutrition of rats. This factor, provisionally called factor Y, is distinguished from the other water-soluble factors (B vitamins) already identified by its high resistance to heat and alkali. In an attempt to clear up the confusion in the nomenclature of the B vitamins, the authors have accepted the use of B_3 to denote "the most heat-labile factor of the group, described by Williams and Waterman [E. S. R., 58, p. 691], present in yeast and whole wheat, and necessary for weight maintenance in the pigeon," and vitamin B_4 "for the heat- and alkali-labile factor described by Reader [E. S. R., 62, p. 589], present in yeast and necessary for the continued growth of the rat. This factor has been known previously as 'vitamin B_3.'"

The existence of the new factor Y was first suspected by Chick and Roscoe (E. S. R., 62, p. 195) in the course of attempts to use egg white as the source of both protein and vitamin B_2 in place of purified casein as the source of protein and an autoclaved extract of yeast as the source of vitamin B_2 in the basal diet for determining vitamin B_1. The longer period of growth on the latter diet led to the suggestion that autoclaved yeast contained a dietary factor absent from egg white.

The inability of egg white as the source of vitamin B_2 to supplement vitamin B_1 in maintaining steady growth in rats was demonstrated more strikingly when the egg white was given to young rats previously deprived of vitamin B_2 and with vitamin B_1 administered in a purified form as Peters' antineuritic concentrate. As noted in the above paper by Chick, Copping, and Roscoe, the egg white causes immediate restoration of growth, with cure of dermatitis if the latter is present, but growth soon ceases and is not restored again by increasing the dosage of egg white.

Additional data along this line are reported in appendixes describing the use of autoclaved yeast and egg white, respectively, as sources of vitamin B_2 in studies of the vitamin B_1 content of various foods. When dried yeast and certain water extracts of yeast, ox liver, egg yolk, and various green vegetables were tested for their content of vitamin B_1 it was found immaterial whether the vitamin B_2 was supplied in the basal diet as autoclaved yeast products or as egg white, but with meat, wheat embryo, and the white inner leaves of cabbage growth was inferior when egg white served as the source of B_2. In testing onions and Peters' antineuritic B concentrate, concordant results were obtained with large but not small dosages of egg white. These results are interpreted as indicating that the foods in the first group contained an abundance of the new factor which was present in smaller amounts or entirely lacking in the other materials tested.

The egg white diet was made satisfactory for growth by the addition of a small daily ration of an aqueous yeast extract which had been autoclaved in alkaline solution (pH about 10) for four hours at from 120 to 125° C., and which was proved to be entirely devoid of vitamin B_2.

The somewhat conflicting results reported in the literature on the stability of the various B vitamins to heat and alkali are summarised in tabular form and discussed. Of these, the antineuritic vitamin B_1 is generally acknowledged to be relatively labile to heat and alkali and the antidermatitis vitamin B_2

relatively heat stable at a temperature of about 120° in neutral or acid solution. There is lack of agreement concerning its stability to alkali at this temperature. Vitamin B_3 (Williams and Waterman) is considered to be the most sensitive to heat, unstable at 60°, while vitamin B_4 is similar to vitamin B_1 in its stability to heat. "The new water-soluble dietary factor Y dealt with in this communication appears to be the most resistant of the group, for it can survive heating for four hours at 120–125° at a pH of about 10."

A quantitative comparison of the curative activity of torulin (vitamin B_1) upon the adult pigeon and the adult white rat, H. W. Kinnersley, R. A. Peters, and V. Reader (*Biochem. Jour., 24 (1930), No. 6, pp. 1820–1823*).—A comparison is reported of the curative value for pigeons and rats of various vitamin B_1 (torulin) preparations. The pigeon tests were conducted by the method previously described (E. S. R., 59, p. 294). In the rat tests adult rats of approximately maximum weight were fed a diet of casein 20, rice starch 70, agar 2, salt mixture 5, cod-liver oil 3, and alkaline autoclaved yeast extract 6 parts. On this diet, after a marked loss in weight, convulsions usually occur rather suddenly in from 21 to 24 days. These are accompanied by partial paralysis, especially of the hind legs. These symptoms are thought to be the true polyneuritic symptoms curable by vitamin B_1 in its purest form. The test doses are given by mouth from a pipette as soon as possible after the onset of the symptoms. With active materials a marked improvement may often be noted within 20 minutes and always in from 2 to 3 hours if not less than a 3-day dose is given. The time of the second onset of convulsions depends upon the size of the dose given.

The materials tested on both pigeons and rats consisted of four different preparations varying in activity from one with a pigeon day dose of 0.025 mg. organic solids to one of 1.2 mg. With all but one of these preparations the number of pigeon and rat day doses of a given amount of the preparation were approximately identical, leading the authors to state "we think that the figures leave no doubt in the mind that we are dealing with the same factor in the rat and the pigeon."

The paper includes a reply to the objections raised by Smith (E. S. R., 63, p. 291) to the pigeon cure test.

The curative activity of the antineuritic vitamin of rice, B. C. P. Jansen, H. W. Kinnersley, R. A. Peters, and V. Reader (*Biochem. Jour., 24 (1930), No. 6, pp. 1824–1826*).—A crystallized specimen of antineuritic vitamin hydrochloride prepared in Amsterdam from rice polishings by the method described by Jansen and Donath (E. S. R., 57, p. 489) was tested by the authors in three different ways: (1) By curative pigeon tests, (2) by curative rat tests as described in the paper noted above, and (3) by *Streptothrix corallinus* tests as described by Orr-Ewing and Reader (E. S. R., 60, p. 412). The activity of the preparation in terms of pigeon day doses was 0.007 mg. by injection and 0.009 mg. by mouth and of rat day doses 0.005 mg. The activity as determined by the use of *S. corallinus* was 0.006 mg. per day.

From the rat values it is estimated that the maximum daily dose of the crystals from rice polishings needed for the rat for growth to maximum weight does not exceed approximately 0.011 mg. daily. In this connection a note added in proof states that the vitamin crystals also contain vitamin B_4.

A comparison of the intensity of the Pauly reaction given by one of the purest torulin preparations with that given by an equivalent quantity of the rice vitamin showed slightly more intense color of the torulin preparation than of the rice vitamin.

Maintenance nutrition in the adult pigeon, and its relation to torulin (vitamin B_1), I, II, C. W. Carter, H. W. Kinnersley, and R. A. Peters

(*Biochem. Jour.*, *24* (*1930*), *No. 6*, *pp. 1832–1843*, *figs. 3*, *pp. 1844–1851*, *figs. 4*).—The term weight maintenance in pigeons, as used in these two papers, is defined as a condition in which the weight remains constant over a period of 30 or more days, with a continuous daily rise or fall of not more than 1 gm. In addition to this maintenance nutrition, the authors recognize a rising and falling nutrition and a weight minimum which is about 60 per cent of the weight maximum.

The first paper presents further proof of the earlier contention of Kinnersley and Peters (E. S. R., 55, p. 409) that a curative and protective vitamin B_1 preparation does not give maintenance nutrition in pigeons on polished rice. The evidence consists essentially in showing that a daily dose of 1 gm. of marmite is sufficient to convert a falling nutrition upon polished rice into maintenance at almost any point between the minimum and maximum weight, but that a large amount of vitamin B_1 concentrate in the form of a N/10 HCl extract of activated charcoal prepared by the Kinnersley and Peters method is ineffective. Since this amount of marmite contains 4.3-day doses of vitamin B_1 and the extract as many as 12 doses, the conclusion is drawn that such vitamin B_1 extracts as suffice for maintenance must be composite. Maintenance nutrition was secured on doses of a 50 per cent alcoholic extract of the activated charcoal furnishing 5- to 8-day doses of vitamin B_1. This indicates that this extract is not as pure a source of vitamin B_1 as the acid alcohol extract.

In the second paper evidence is presented that the factor in marmite and in the alcohol extract giving maintenance nutrition is not identical with the pigeon factor B_3 of Williams and Waterman (E. S. R., 60, p. 293) or with the rat factors B_2 and B_4. The three lines of evidence which, in the opinion of the authors, show that the unknown factor is not vitamin B_3 are summarized as follows:

"Firstly, the statements of the American authors that vitamin B_3 is not present in extracts prepared by our methods. Secondly, it is most unlikely that vitamin B_3 could stand the alkaline heating, even if it were present in small traces in the marmite. Thirdly, we should have to believe that very large increases in the maintenance amount were necessary to convert to rising nutrition."

Evidence that the factor is not vitamin B_2 consists in the fact that the alcohol concentrate which proved capable of bringing about maintenance nutrition had previously been shown to be devoid of vitamin B_2. That it is not vitamin B_4 is evident from the failure of a concentrate of vitamin B_4 to bring about maintenance nutrition when used as a supplement to the ineffective acid extract and from the ability of alkalized marmite known to be lacking in vitamins B_1 and B_4 to supplement the acid extract.

As a help in distinguishing between the various B vitamins, a table is given of their distribution in various experimental materials. The most distinguishing characteristic of vitamin B_5 appears to be that it is not destroyed by heating for 35 minutes at 100° C. in the presence of N/2 NaOH, a treatment known to destroy vitamin B_1.

The assay of vitamin B_4, V. READER (*Biochem. Jour.*, *24* (*1930*), *No. 6*, *pp. 1827–1831*, *figs. 2*).—An adult rat curative method for the determination of vitamin B_4 (formerly named B_3) is reported essentially as follows:

Rats which have attained maximum weight on a diet containing vitamins B_1 and B_3 and adequate but not excess vitamin B_4 for normal growth (E. S. R., 64, p. 195) are deprived of both the alkali-labile vitamins B_1 and B_4 until polyneuritis occurs in from 3 to 4 weeks. A vitamin B_1 concentrate is then administered, following which the typical polyneuritic symptoms are cleared up but the animal remains "in a weak condition, with swollen red paws, spastic gait,

loss of coordination, and other symptoms apparently due to the specific lack of vitamin B_4." The material to be tested for vitamin B_4 is now administered daily. If it contains no vitamin B_4 the animal becomes weaker and usually dies within 10 days without any further marked loss in weight, but if B_4 is present the animal begins to gain weight and the symptoms gradually disappear. When an animal has been completely restored to its original weight it may be used again for the same test.

It is noted particularly that the symptoms which have hitherto been attributed solely to lack of vitamin B_1 are in reality due to the dual deficiency of vitamins B_1 and B_4. Papers by Smith (E. S. R., 63, p. 291) and Sandels (E. S. R., 63, p. 895) on vitamin B_1 are discussed as possible of reinterpretation in certain points in the light of knowledge of the existence of vitamin B_4 and of the symptoms due to lack of this vitamin.

An appendix contains directions for the concentration of vitamin B_4 from the mercuric sulfate precipitate from distillery yeast.

Vitamin B deficiency in the rat.—Bradycardia as a distinctive feature, A. N. DRURY, L. J. HARRIS, and C. MAUDSLEY (*Biochem. Jour., 24 (1930), No. 6, pp. 1632–1649, figs. 4*).—Evidence is presented leading to the conclusion that deprivation of the vitamin B complex leads to a severe bradycardia, or retardation of the heart rate, in young rats. "The slow heart rate is due, not to the lowered food consumption but directly to the absence of the vitamin; for, (1) control animals on restricted amounts of complete synthetic diets fail to develop the bradycardia until moribund, (2) the bradycardia can be cured rapidly in the entire absence of food by injection or ingestion of vitamin B concentrates, and (3) prolonged restoration to normal heart rate can be effected by adequate provision of vitamin B, even when the food intake is restricted to the amount consumed in the last stages of the avitaminosis and the animal fails to make up lost weight."

Tests of various sources of vitamin B_1 and B_2 as curative agents for this bradycardia have given positive results with the former and negative with the latter. The curative substance, moreover, appears to be comparatively readily destroyed by heat. The authors are unwilling to state definitely that vitamin B_1 is the curative agent, on account of the small number of preparations examined and the present uncertainty concerning the number of vitamins in the vitamin B complex. It is thought, however, that the bradycardia test will prove of value in future work on the separation of the constituents of vitamin B.

Preliminary observations have shown that the absence of vitamin A and vitamin D alone or combined is without effect on the heart rate. Excess of vitamin D, as previously noted by Harris and Moore (E. S. R., 62, p. 196) produces a very slight bradycardia.

Vitamin D content of the liver oil of the dogfish, Squalus sucklii (Girard), H. N. BROCKLESBY (*Proc. 4. Pacific Sci. Cong., Java, 1929, vol. 3, pp. 383–394*).—Essentially noted from another source (E. S. R., 63, p. 294).

A critique of the line test for vitamin D, C. E. BILLS, E. M. HONEYWELL, A. M. WIRICK, and M. NUSSMEIER (*Jour. Biol. Chem., 90 (1931), No. 2, pp. 619–636, figs. 6*).—This paper, which should be read in the original by those interested in the use of the line test for the quantitative determination of vitamin D, describes certain refinements in the technic for this test, with a series of supplementary sketches showing different degrees and types of healing comprised within each of the four standards.

From the data obtained in 10,000 vitamin D assays by the line test, certain numerical relations between the degree of healing produced and the dosage which produced it have been determined by graphic analysis. Adhering to the

use of an average cod-liver oil as the standard of comparison, this being defined as that which induces 2+ healing when administered to rickety rats at 0.25 per cent on diet 3143 for 5 days, graphs have been developed by means of which it is said to be possible to translate any observed degree of healing into the 2+ basis, or to calculate the exact potency of a particular solution.

A statistical study of the results obtained in the assay of a standardized solution of irradiated ergosterol on 200 rats, 100 male and 100 female, is reported, with the conclusion that neither the sex, color, nor weight of the rats is an important factor in the line test, that it makes little difference whether the vitamin is administered with the diet or separately, and that the average daily food consumption bears little relation to the healing period, but that there is a definite correlation between the food consumed during the first day and the line test findings.

Heart block in pigeons, curative factor, C. W. CARTER (*Biochem. Jour., 24 (1930), No. 6, pp. 1811-1819*).—In this attempt to determine the dietary factor or factors essential for the prevention or cure of heart block previously noted as occurring in pigeons on a polished rice diet (E. S. R., 62, p. 596), the following substances were tested as curative agents—a vitamin B_1 concentrate prepared by the Kinnersley and Peters method (E. S. R., 58, p. 89), marmite, baker's yeast, brewer's yeast, whole wheat, wheat heated in a steam bath at 100° C. for 5 hours, ether-extracted wheat, and the ether extract of wheat.

The vitamin B_1 concentrate was ineffective, marmite slightly effective, and yeast, wheat, and ether-extracted wheat effective. The condition of heart block was produced on synthetic diets containing adequate protein, fat, carbohydrate, and inorganic salts supplemented by cod-liver oil, showing that the recognized deficiencies in polished rice are not responsible for the development of this condition. Attention is called to the similarity of the distribution of the effective factor with the Williams and Waterman vitamin B_3, but it is thought that "until it has been found possible to obtain this factor free from the other constituents of the vitamin B complex it will be impossible to decide whether this is identical with the substance present in wheat and yeast on which the normal function of the heart depends."

The cause of mottled enamel, a defect of human teeth, M. C. SMITH, E. M. LANTZ, and H. V. SMITH (*Arizona Sta. Tech. Bul. 32 (1931), pp. 253-282, figs. 7*).—In this preliminary report, evidence is presented leading to the conclusion that mottled enamel, a tooth defect first reported in the United States in 1916 and now recognized as endemic in various communities throughout this country, as well as in other parts of the world, is caused by the destructive action of fluorine present in the water supplies of the afflicted communities.

The investigation started with a survey of the occurrence of mottled enamel among practically all of the inhabitants of St. David, Ariz., where the condition was endemic. Tabulated data on the extent of this condition in 39 representative families (250 individuals) showed that with almost no exception every person recorded who was born and reared in the immediate vicinity of St. David or who came there in the early years of life showed mottling of every permanent tooth, while all who were born elsewhere and began residence in the community only after the permanent teeth had erupted were entirely free from this defect. Those who came to St. David for continued residence between the ages of 6 or 7 and 12 years showed mottling in the teeth that erupt during those years, but not in the earlier permanent teeth.

Since the distribution of the defect appeared to be related solely to length of residence in the community and since very little of the food supply is raised locally, it was thought unlikely that dietary habits were the primary cause of

the defect. The water supply is chiefly artesian, but ordinary analyses revealed no deficiency in commonly occurring elements.

Simultaneously with the survey of the extent of mottled enamel in St. David and other communities feeding experiments were conducted on laboratory animals, chiefly rats. Special attention was paid to diets containing insufficient amounts of calcium, phosphorus, and vitamin D and to a comparison of the St. David water with distilled water. Although abnormalities of the teeth were produced by the deficient diets, the defects were not typical of mottled enamel. No destructive effect of the water upon the teeth was noted when the diet was adequate, but when the diet was in itself sufficiently defective to produce observable changes in the incisors the rats receiving the St. David water were affected at an earlier age. When the St. David water was concentrated to one-tenth of its original volume, a condition apparently identical with mottled enamel was produced in a short time even in rats on a satisfactory diet.

Another series of experiments in which chemical compounds suspected of being capable of interfering with enamel calcification were added to the water or food supply of the rats yielded results similar to those obtained with the St. David water when the salt added was sodium fluoride in amounts of 0.025, 0.5, and 0.1 per cent of the ration.

The final link in the chain of evidence pointing to fluorides as the cause of the defect consisted of quantitative analyses for fluorine of the water of St. David and other Arizona communities. These showed that the water from non-endemic communities contained only small amounts of fluorine (0 to 0.3 mg. per liter), while that from St. David and other endemic localities contained abnormal amounts, 3.8 to 7.15 mg. per liter.

It is of interest that the water supply of the one family in St. David not having mottled enamel was from a deeper well than the others in the community and contained only 0.72 mg. of fluorine per liter. The finding near St. David of mastodons, the bones and tusks of which are abnormally high in fluorine, suggests one possible source of contamination in this locality.

Hemoglobin production.—II, The relief of anemia, due to milk diet, by feeding amino acids, D. L. Drabkin and H. K. Miller (*Jour. Biol. Chem., 90 (1931), No. 2, pp. 531–543, figs. 4*).—In this continuation of the series noted previously (E. S. R., 65, p. 92) experiments are reported in which milk anemia in rats has been relieved by the addition of pure amino acids to the milk. Of the amino acids thus far studied, arginine, glutamic acid, and their salts brought about continuous and progressive improvement. Tryptophane, pyrrolidonecarboxylic acid, sodium aspartate, and a proline mixture produced an initial increase in hemoglobin, followed by maintenance at the higher level or the return of severe anemia. Alanine, alanine hydrochloride, histidine dihydrochloride, and hydrochloric acid were of no value for hemoglobin production.

In commenting upon these findings, the authors state that "to reconcile the experiments in which anemia was cured by adding sufficient iron or iron and copper to the diet with the present demonstration of hemoglobin production by the addition of pure amino acids to milk containing a low quantity of iron would, at first view, appear to be a most difficult matter. One possibility is that certain organic as well as inorganic substances may exert a beneficial influence locally in the digestive tract of the milk anemic rat, permitting a better or different utilization of foodstuffs already available in the milk. The direct stimulation of blood-forming organs by the two different types of substances, after they are absorbed, is another possibility."

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TEXTILES AND CLOTHING

A modified method for determining the tendering of cotton, R. ELMQUIST (*Jour. Home Econ., 23 (1931), No. 1, pp. 62–66*).—The method described, which has been developed at the Bureau of Home Economics, U. S. D. A., in connection with a study of the effect of ironing temperatures on cotton fabrics, is a modification of the Hägglund[5] method for the determination of copper value based upon Bertrand's procedure for the analysis of sugars.

The cotton is prepared for the determination in a special nonheating mill with a cutting rather than a tearing action. Mechanical cutting is thought to be more desirable than hand cutting, on account of being more rapid and giving particles of more even and smaller size than is possible with hand cutting. Other modifications include the use of a glass-sintered filter crucible in place of a Büchner funnel or a Gooch crucible, and of molybdophosphoric solution in place of ferric sulfate in the oxidation of cuprous oxide. Titration errors are reduced by using a microburette when the volume of the potassium permanganate solution is small.

The technic of the procedure is described in detail.

Laundry "winter damage," J. B. WILKIE ([*U. S.*] *Bur. Standards Jour. Research, 6 (1931), No. 4, pp. 593–602, pls. 4, figs. 2*).—The term "winter damage" is used to describe the excessive deterioration frequently undergone by laundered cotton fabrics dried out of doors in the wintertime in New England. Analyses of such damaged fabrics and studies of the rate of deterioration of cotton cloth when laundered and dried indoors and out indicated that the damage is caused by sulfuric acid which is formed in the damp fabric by the oxidation of atmospheric sulfur dioxide, a reaction accelerated by traces of iron, of spent bleach liquor, and of acetic acid which may occur in the laundered fabrics. This conclusion was confirmed by the production of similar deterioration in cotton cloth under artificial conditions in the laboratory. It is thought that winter damage may occur even when there is less sulfur dioxide in the atmosphere than 1 part per million, especially when the cloth remains damp and in contact with the atmosphere for a relatively long time.

In attempts to find some agent which might decrease or prevent the damage, the best results were obtained when calcium chloride and sodium bicarbonate were added to the rinse. A procedure for this treatment was developed and put into practice in several commercial laundries in New England. During the winter of 1928–29 weekly statements from one laundry using the method showed for the entire season 1 damaged piece (approximate weight per piece 0.4 lb.) per 5,000 lbs. as compared with an average of 10 pieces per 5,000 lbs. reported from eight laundries not using the treatment.

MISCELLANEOUS

Forty-third Annual Report of [Rhode Island Station, 1930], B. E. GILBERT (*Rhode Island Sta. Rpt. [1930], pp. 27–49*).—This report includes experimental work and meteorological data, for the most part abstracted elsewhere in this issue.

Forty-third Annual Report [of Vermont Station, 1930], J. L. HILLS (*Vermont Sta. Bul. 319 (1930), pp. 24*).—This contains the organization list, a report of the director, and a financial statement for the fiscal year ended June 30, 1930. The experimental work reported is for the most part abstracted elsewhere in this issue.

Agricultural research in Scotland in 1930 (*Highland and Agr. Soc. Scot. Trans., 5. ser., 43 (1931), pp. 155–172*).—A brief summary of the work carried on at the Scottish agricultural research stations during the year.

[5] Cellulosechemie, 11 (1930), No. 1, pp. 1–4, figs. 2.

NOTES

Hawaii University.—A recent announcement of the Graduate School of Tropical Agriculture calls attention to the facilities being offered for research and graduate training in the sciences pertaining to tropical agriculture at this institution through cooperation with the university, the Hawaiian Sugar Planters' Association Experiment Station, the Association of Hawaiian Pineapple Canners Experiment Station, the college station, and the Bishop Museum. The major emphasis is placed on nondegree work, but a limited number of candidates are accepted for the M. S. and Ph. D. degrees. Graduate fellowships providing for part-time service on the research staffs of some of the cooperating institutions are available along certain lines.

Minnesota University and Station.—Dr. W. A. Riley, chief of the division of entomology and zoology, is spending a year's sabbatical leave at the University of Lingnan, China, where he will give courses in entomology and biology and pursue studies of human parasitology, making side trips into the interior for securing specimens. During his absence, A. G. Ruggles is acting chief of the division.

Nevada Station.—The Adams fund project entitled Timber and Snow Studies and Snow Surveying has been revived, with Dr. J. E. Church, jr., as project leader. The immediate objective of this project is the completion and publication of the method of snow surveying and run-off forecasting developed by Dr. Church and his associates.

New York State Station.—Recent enactments of the legislature provide that beginning July 1 all bacterial cultures for the inoculation of legumes offered for sale in New York will be subject to inspection by the station, working in cooperation with the State Department of Agriculture and Markets. Samples of legume inoculants found on the open market will be collected by representatives of the department and submitted to the station for laboratory and greenhouse tests under the supervision of the station bacteriologist. It is reported that preliminary examination of numerous cultures already collected has shown a wide range of differences in the kind and number of bacteria present, almost half of the samples failing to show any legume bacteria or being so contaminated by other types as to be of doubtful value as legume inoculants.

Oregon College.—Dean Ava B. Milam of the School of Home Economics has been given a year's leave of absence to be spent in a study of home economics curricula of some of the leading women's colleges of Japan and China.

Clemson College.—The textile department has installed a very complete testing laboratory, equipped with automatically controlled air conditioning units whereby any desired temperature between 65 and 85° F. and any relative humidity between 50 and 100 per cent may be secured. The laboratory will be available for research and demonstration purposes.

Wisconsin University and Station.—*The Wisconsin Country Magazine* states that the contract has been awarded for a new animal research laboratory, for which $35,000 is available for building and equipment. This laboratory will be used by all departments making up the Wisconsin Institute of Animal Research, including animal husbandry, veterinary science, genetics, agricultural chemistry, agricultural bacteriology, and poultry husbandry. A two-story

building 40 by 60 ft. is contemplated, with the ground floor equipped for nutrition research with space for 10 cows on metabolism trials and metabolism crates for smaller animals, and the second floor providing facilities for the slaughter, autopsy, and study of the experimental animals. A small refrigerating plant will permit the holding of the carcasses and tissues at low temperatures for an indefinite period.

Asher Hobson, for seven years American representative at the International Institute of Agriculture and subsequently director of the foreign agricultural crop and market information service of the U. S. D. A. Bureau of Agricultural Economics, has been appointed professor of agricultural economics and will be in charge of work in cooperative marketing and international agricultural relations.

Soviet Institute for Plant Protection.—This institute was established under a decree of June 25, 1929, as one of the institutes of the Academy of Agricultural Science. Its object is to develop in a centralized way scientific work connected with the protection of plants and animals from diseases and other pests, these activities having previously been carried on merely by local institutions. The present organization consists of divisions of administration, economics, applied entomology and zoology, phytopathology, and preventive measures. The administrative headquarters and the division of entomology and parts of the other divisions are located on Yelagin Island, Leningrad, mainly in the buildings and grounds of Yelagin Palace. The division of phytopathology and parts of the divisions of entomology and preventive measures are also in Leningrad or near by, while the laboratories and manufacturing plant of the division of preventive measures, which has to do chiefly with insecticides, fungicides, and apparatus for their application, are located in Moscow. The equipment includes an insectary and museum on Yelagin Island, a herbarium, and a library of about 65,000 volumes, of which about 40,000 deal with phytopathology. The entire staff numbers 198, of whom 150 are technical workers and their assistants, and is headed by the director of the institute, N. V. Kovalev.

According to the plan as announced, the central institute will be supplemented by similar institutes in the Ukraine, Transcaucasia, and Central Asia, while existing institutions are to be reorganized into 12 of what are called "scientific experimental bases," and from 3 to 12 "agricultural stations," headed by the various institutes, are contemplated for each of the various regions and provinces of the Soviet Union.

Miscellaneous.—The Czechoslovak Academy of Agriculture is the beneficiary of two funds recently established. One of these is the Joseph Munzar Fund of 30,000 Czechoslovak crowns (about $888) given by Miss Anne Munzarová, the interest from which is to be awarded for agricultural studies and treatises based on scientific discoveries. The other is the Joseph Horák Fund of 500,000 Czechoslovak crowns (about $14,810) given by Dr. Horák for aiding deserving teachers in popular farm schools.

A gift to the University of Cambridge by the International Education Board of £700,000 on condition that the university secured £479,000 from other sources has now become available. It is announced that £162,000 has been allotted to the agricultural work of the university, including the building and equipment of a new laboratory.

School and Society states that under the will of the late Mrs. du Pont Chandler the University of Pennsylvania has been given $50,000 as a foundation to promote the study of agriculture.

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EDITORIAL

BABCOCK AND SPILLMAN, DECEASED

Early in July, 1931, two more eminent pioneers in agricultural science passed away. One of these was Dr. Stephen Moulton Babcock, who died in Madison, Wis., July 1 at the advanced age of 88 years. The other was Dr. William Jasper Spillman, principal agricultural economist in the U. S. Department of Agriculture, whose death occurred suddenly on July 11 in Washington, D. C. Although these two men differed widely in their field of work, their period of maximum productivity, and in many other respects, they had in common the enthusiasm and the spirit of adventure which characterizes the explorer of unknown realms of science, and each in his own time and way contributed much to the advancement of knowledge and the practical betterment of mankind.

The death of Dr. Babcock has brought to a close the career of one whose name is doubtless more widely known and more generally acclaimed than any other which has been associated with the agricultural experiment stations. For nearly 40 years he has been a unique and outstanding figure, personifying in the popular mind the practical objectives of these institutions of utilizing the methods of science in the direct betterment of the agricultural industry. This is not surprising, for he revealed in a concrete way the extensiveness of the economic returns possible by even a single relatively simple discovery, and by his signal success at an early stage of station research helped greatly to convince the skeptical and insure for agriculture a fair trial of the experimental method.

The essential details of Dr. Babcock's long life are readily assembled. He was born in Bridgewater, N. Y., on October 22, 1843, and graduated from Tufts College in 1866 without marked specialization in any field. Most of the following decade was spent in further study at the Rensselaer Polytechnic Institute and in farming at his

boyhood home. This farm was not far from Ithaca, and its proximity was doubtless a factor in his becoming a student and instructor at Cornell University under Dr. G. C. Caldwell from 1875 to 1877. Here his interest in agricultural chemistry was awakened, and in 1879 after two years in Germany he received the Ph. D. degree from Göttingen University. Returning to Cornell for service from 1881 to 1882, in the latter year he became chemist of the newly established New York State Experiment Station at Geneva. In 1888 he was appointed professor of agricultural chemistry in the University of Wisconsin and chief chemist of the Wisconsin Station, and in 1901 was also made assistant director of the station. In 1913 he retired from formal responsibility, but continued his studies in the station laboratories with unabated interest and enthusiasm until shortly before his death.

As former Dean Russell has pointed out in a recent tribute, "the world at large knows Babcock primarily for the beneficent invention of his famous test for butterfat, whereby the intrinsic value of milk could be easily and accurately determined." The task of devising a simpler procedure, suitable for lay use, was among the first to be assigned him by Dean W. A. Henry at Wisconsin, and was completed in 1890. While a number of other tests had already been proposed for the same purpose, this excelled them all in simplicity, inexpensiveness, and rapidity of manipulation. To quote Dean Russell again, it "came at a most opportune time and is one of the foundation stones on which the modern science of dairying has been built. Prior to this time, dairying was merely a haphazard art, but with this tool in hand the tremendous advance in the improvement of the special dairy breeds of cattle became possible. The widespread utilization of the Babcock test made such unscrupulous practices as adulteration, watering, and skimming the milk no longer profitable, because the test enabled such deceit to be quickly detected." Important also was the service which it rendered to patrons of creameries by revealing with expedition and accuracy the true fat content of their milk and enabling payment upon a basis which is rational and stimulating.

From the point of view of experiment station development, the great intrinsic value of the Babcock test was further augmented by at least two important precedents in connection with it which were established by its sponsor. One of these was his insistence upon thorough testing of his proposed method before permitting its public use, an insistence justified, in spite of the urgent need, by its eventual promulgation in a form so complete and satisfactory as to remain to-day without essential modification. The other precedent was his announcement that the invention was not to be patented but would

be freely available to the world. The influence of these two precedents in promoting the dependability of station work despite pressure for immediate results, and in indicating that the public was not expected merely to foot the bill for the losses in experimentation but could hope to benefit fully when success was attained, was doubtless very great in developing confidence in the days when the stations were themselves experiments and their future still uncertain.

Dr. Babcock's later activities were both personal and inspirational, and such was his characteristic reticence in such matters that the precise sphere of his influence is not always readily determinable. Dr. Russell points out that "the joy of conquest appealed to him as it does to the finder of some undiscovered bourne, yet he would have hated to have been forced to organize his discoveries and reduce them to formal treatment." In consequence, much that he did is doubtless still unrevealed. As an actual contribution to the advancement of science, he himself is said to have regarded his studies on the production of "metabolic water" in insects as his most important biological work. Announcement has also been made that the record of his researches since retirement upon the constitution of matter had been reduced to written form and bequeathed to the University of Wisconsin, and it is hoped will soon be available for study.

Special mention should be made of his important influence on nutrition research. Concerning this matter, Dr. Russell has said that "it was Babcock's refusal to adopt the then prevalent notion that a completely balanced ration could be constructed on the basis of chemical analysis that led later here at Wisconsin to the epoch-making discoveries in the field of vitamin research and the rôle of mineral elements in the nutrition of animal life. While Babcock was a chemist, he was no such blind adherent to chemical methods that he lost sight of the fact that life was made up of something which could not be put into a test tube. Twenty-five years ago, Hart and his colleagues started their famous single ration diet for cattle, the results of which have made it necessary to rewrite almost wholly the textbooks on nutrition, both as to the human as well as the animal. The germ of this suggestion came from Babcock's untrammeled mind. It was here that the torch was passed from the hand of the master to the pupil."

Appreciation of Dr. Babcock's work was widespread and resulted in many honors. Tufts College, his Alma Mater, bestowed upon him the LL. D. degree in 1901, and the University of Wisconsin, the scene of his major activities, the D. Sc. degree in 1917, while the University of Göttingen renewed after 50 years its Ph. D. degree to this "extraor-

dinarily distinguished investigator in the chemistry and bacteriology of milk and therefore of agriculture in general." In 1901 he received from Gov. Robert M. La Follette a gold medal presented by the State of Wisconsin for his services to the dairy industry and at about the same time the grand prize in agriculture of the Paris Exposition, a distinction not bestowed upon any other individual.

As a fitting climax to these honors, in 1930 he was the first to receive the Capper Award for Distinguished Service to American Agriculture. Concerning this award, it was remarked in these columns that "it need scarcely be said that this decision recognizes the claims and ideals of research to an exceptional degree, and that the honor will be widely applauded as highly appropriate and richly deserved." The many eulogies which have followed his death have emphasized anew the value of his services, and the esteem with which was regarded one aptly characterized by President Frank of the University of Wisconsin as "shy benefactor of mankind everywhere."

Dr. Spillman belonged to what may be termed the second generation of agricultural teachers and investigators in this country, the group whose service was enlisted during the days of expansion following the passage of the Hatch Act. Born in Lawrence County, Mo., on October 23, 1863, he was graduated from the University of Missouri in 1886 and received the master's degree in 1889. After brief periods of teaching in the State normal schools of Missouri and Oregon and in Vincennes University, he was appointed professor of agriculture in the Washington College and agriculturist of the Washington Station in 1894. Eight years later he entered the U. S. Department of Agriculture as agrostologist in charge of grass and forage plant investigations, and aside from a brief interlude from 1918 to 1921 as editor of the *Farm Journal* was thereafter connected with the Department until his death.

Experimentation at the Washington Station was still in its infancy when Dr. Spillman began his labors there. The station was not organized until 1891, and the college was not open for instruction until the following year. Very naturally, therefore, his early work took the form of a sort of agricultural survey of this little-known region, and much useful information was obtained as to soils and crops adapted to different sections of the State, cultural methods, the seeding of pastures, and the cultivation of native grasses. Among the needs which were soon realized was that of a better winter variety of wheat for eastern Washington, and this need Dr. Spillman attempted to supply by crossing the most promising winter varieties with the leading spring sorts adapted to the region. Not only did

he accomplish much in his immediate objective, but his extensive hybridization studies constituted an important contribution to genetics as well. By them, according to Bailey and Gilbert, "Mr. Spillman independently discovered numerical results before the knowledge of the Mendelian experiments had become generally known." Some of his findings were reported in a paper read before the Association of American Agricultural Colleges and Experiment Stations in 1901, in which he declared that "while the results here reported are not sufficient to justify the positive assertion that certain quantitative laws govern the transmission of parental characters to hybrid offspring, yet they point so strongly in this direction that we may state some of these laws provisionally, looking to future investigation for their confirmation, modification, or rejection."

Not the least significant part of this paper of Dr. Spillman was his earnest plea for more attention by station investigators to quantitative studies in plant breeding, and his influence doubtless helped to give considerable impetus to such investigation. Subsequently, he himself made numerous contributions to methodology by his utilization of mathematical processes, for which he possessed unusual aptitude. In 1920 he announced the discovery of the mathematical form of the law of diminishing returns with relation to the results of the use of fertilizers on farms, and just before his death he completed a means of solving arithmetically for several variables the exponential yield curve or law of biological growth.

Dr. Spillman came to the Federal Department of Agriculture at a time when the need was being somewhat dimly visualized of supplementing research in the production phases of agriculture by attention to economic problems as well. Many of these problems lay in the field of farm management, virtually untilled until in 1902 studies of type of farms and farming methods were instituted under his direction. For a time this work was conducted as a part of his duties as head of the division of grasses and forage crop investigations, but in 1904 the Office of Farm Management was set up under the supervision of a committee of which he was chairman. A little later he was given full charge of this office and continued in that capacity until his resignation from the Department in 1918.

In the words of an early report, this office was intended to serve as a bridge connecting farm practice and the laboratory of the investigator. It began the gathering of information concerning farm practice in the various sections of the country, the securing of records of the crops grown, the manner of growing them, the rotations practiced, and the methods of handling manure and of harvesting

and disposing of crops on a number of typical successful farms, encouraged farmers to visit and study work at experiment stations and on successful farms in their own vicinity, and undertook various other related lines of activity.

One of the most important achievements of the office during this period was the development of the farm management survey and the utilization of this method of approach to farm problems on a large scale and in many representative areas. Dr. Spillman became a most enthusiastic advocate of this method, even raising the question in an address before the Society for the Promotion of Agricultural Science in 1912 as to "whether the average of a large number of estimates by farmers is not more accurate than the results obtained in ordinary plat experiments in the field." Many miscellaneous studies were also made under his direction, among them the collecting of data as to the machinery cost of farm operations; the carrying capacity of ranges; the duty of implements, workmen, and crews; seasonal distribution of farm labor; and the experience of farmers with tractors, clearing land, and the operation of various farm implements. Extended inquiries were made as to the cost of producing apples and sugar beets, and more or less cost work was done on cotton, milk, wheat, and other products. Attention was also given to historical and geographical studies, including the preparation of a geography of world agriculture and several sections of an atlas of American agriculture. In not a few of these projects his personal influence and contributions by speech and pen was considerable. His leadership in the field of farm management was early manifested, and he was made the first president of the American Farm Management Association, now the American Farm Economic Association, upon the formation of that body in 1910.

Established "to investigate and encourage the adoption of improved methods of farm management and farm practice," the Office of Farm Management soon began through its regional agents to carry its results to the farmers themselves. In 1909, demonstration tests of new varieties of corn, legumes, and other crops on individual farms under supervision of a farm management agent were made in four districts of Ohio in cooperation with the Ohio Experiment Station, and the following spring an agent paid by the bureau was employed to carry on similar work in Pennsylvania. Other county agents were soon appointed throughout the North and West under various auspices, and in 1912 the Office of Farm Management received about $161,000 for farm demonstration work in these areas. By the time the Smith-Lever Act went into operation in 1914, 203 county

agents were thus employed and ultimately constituted an important nucleus in the Office of Extension Work, to which under the reorganization of activities they were transferred. Many of these agents gave special attention to problems associated with the business side of farming, but another phase which attracted much notice was boys' club work in the Northern States. All of these activities made their initial development under Dr. Spillman's general supervision, so that to his pioneer work in cereal improvement, plant breeding, and farm management there came to be added an important decade of leadership in the new field of extension.

Dr. Spillman's unusual record of accomplishment in so many and so diverse fields is reflected in his publications. A list recently compiled in the library of the Bureau of Agricultural Economics reveals over 300 articles from his pen, ranging in scope from popular writings for the farm press to extremely technical and abstruse mathematical dissertations. His versatility is indicated by such titles as the following: Farm Grasses of the United States; Significance of the School Garden Movement; An Interpretation of Elementary Species; International Language; Reformed Calendar; Determining the Mean Length of Life; Future Meat Supply of the United States; The Average Internal Curve and Its Application to Meteorological Phenomena; and, as a final contribution, The Need of Reorganization in Agriculture. He was also in great demand as a speaker, being at home alike in technical circles, in gatherings of farm people, and among what may be termed the general public. Perhaps a reason for this success may be found in his keen and inquiring mind and his originality of thought and utterance. As Mr. C. W. Kitchen, assistant chief of the Bureau of Agricultural Economics, has aptly said. "his pioneering did not end when the field to which he contributed so much in its beginning became one of the major fields of agricultural research. He never lost the faculty of taking up new problems with the enthusiasm of youth and of the pioneer. He did this with a rare combination of ability for mathematical exactness and for vivid illustration of his thoughts in writing and on the platform." If we add to this tribute a recognition of his untiring energy, his broad sympathies, and his marked ability to stimulate and inspire others to action, the conviction deepens that he was a leader well fitted to the time and environment in which he worked, and that he rendered service which was unique, much needed, and of great value.

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

Studies on the dielectric constant of protein solutions.—I, Zein, J. WYMAN, JR. (*Jour. Biol. Chem., 90 (1931), No. 2, pp. 443–476, figs. 5*).—To permit of a study of the dielectric constant of proteins in the light of the Debye theory,[1] two methods based on electrical resonance were developed in the experiments reported in this contribution from Harvard University and are given in working detail and illustrated with diagrams of the apparatus assembly required.

"By means of these methods measurements were made on solutions of the protein zein dissolved in 70 per cent N-propyl alcohol. The results obtained at temperatures ranging from 0 to 80° [C.] and wave-lengths from 4 to 260 meters show the presence of anomalous dispersion and indicate that the zein molecules are highly polar. A quantitative application of Debye's theory leads to a value of about 60×10^{-18} E. S. U. for the permanent electric moment of the molecules, and to values for the relaxation time somewhat smaller than those calculated on the basis of Stokes' formula for the rotation of a spherical particle in a viscous medium. These numerical values are only roughly approximate, however. An extension of the measurements to gels which form when the solutions of zein are allowed to stand showed no change in dielectric constant accompanying gelation. This suggests that the viscosity of the gels is not the ordinary viscosity entering Stokes' expression."

The pH stability region of egg albumin, B. SJÖGREN and T. SVEDBERG (*Jour. Amer. Chem. Soc., 52 (1930), No. 12, pp. 5187–5192, figs. 2*).—The ultracentrifugal methods devised by Svedberg (E. S. R., 62, p. 606) and studied also by the New York State Experiment Station (E. S. R., 62, pp. 407, 606) "have been applied to the study of the pH-stability region of egg albumin," in a study of which the report appears as a contribution from the University of Upsala.

"In the pH-range 4–9 the protein is stable and homogeneous with regard to molecular weight. The mean value 34,200 is in good agreement with the previous determination by Svedberg and Nichols, viz, 34,500. Below pH 4 and above 9 some of the molecules are split up into a noncentrifugible substance. The sedimentation constant of the centrifugible material is independent of pH within the range 3–11 with a mean value of 3.54×10^{-13} at 20°. The molar frictional constant is 2.47×10^{16} at 20°, which value is identical with the molar frictional constant calculated for a spherical molecule of the same molecular mass and density. The egg albumin molecule, therefore, is spherical and has a radius of 2.17 mμ. At pH values lower than 3 the sedimentation increases, indicating the formation of aggregates of denatured protein; at pH values higher than 9 the sedimentation decreases, indicating the breaking up of the whole material. Both the acid and the alkaline decomposition is accompanied by an increase in the light absorption. A comparison of egg albumin and Bence-Jones protein, using the new value of the sedimentation constant for egg albumin, shows a still closer agreement than was formerly found for the molecular constants of these proteins."

[1] Polar Molecules, P. Debye. New York: Chem. Catalog Co., 1929, pp. 172, figs. 33.

The action of formaldehyde on amino acids with special reference to the formation of amines, L. Zeleny and R. A. Gortner (*Jour. Biol. Chem.*, *90* (*1931*), *No. 2*, *pp. 427–441*).—In the experiments reported in this contribution from the Minnesota Experiment Station, casein, the four amino acids alanine, cystine, glutamic acid, and tyrosine, and ammonium chloride were "boiled with formaldehyde in 20 per cent hydrochloric acid solution and the volatile and total nitrogen distributions determined, after different lengths of time. The same four amino acids and ammonium chloride were autoclaved for six hours at about 180° [C.] with formaldehyde in 5 per cent acetic acid solution, and the same nitrogen distributions determined. The Reinecke's salt compounds and the chloroplatinates of the tertiary amines formed in the autoclave experiments were prepared and compared with the corresponding compounds of trimethylamine. The data support the following conclusions:

"Volatile amines to the extent of from 12 to 40 per cent of the total nitrogen are formed when amino acids are boiled with formaldehyde in acid solution. The distribution of primary, secondary, and tertiary amines in these preparations is essentially the same as that when ammonium chloride is boiled with formaldehyde under the same conditions. The rate of deamination of amino acids in acid solution is greatly increased by the presence of formaldehyde. The volatile nitrogen is probably not produced by simple deamination of the amino acid, but through some intermediate nonvolatile compound containing no primary amino group. The end-product of the volatile nitrogen fraction for the amino acids studied is trimethylamine. No evidence was obtained for the formation of amines by decarboxylation of amino acids in the presence of formaldehyde."

The acid and base constants of glycine from cells without liquid junction, H. S. Harned and B. B. Owen (*Jour. Amer. Chem. Soc.*, *52* (*1930*), *No. 12*, *pp. 5091–5102*, *figs. 2*).—In a contribution from Yale University, "making use of 0.1 molal sodium glycinate and glycine hydrochloride solutions, the apparent dissociation constants of glycine have been measured at 25°. The values obtained are $k^{\circ}_{A}=4.92\times10^{-3}$ and $k^{\circ}_{B}=5.56\times10^{-5}$. For purposes of comparison, we may write $k^{\circ}_{A}=K_{A}$, and $k^{\circ}_{B}=K_{B}$, because, for the dilution we have used, the error introduced by this approximation is negligible compared to the discordance among the various values of K_{A} and K_{B} recorded in the literature. Branch and Miyamoto list the results of six independent electrometric studies of glycine besides their own. If we include our results and those of Bjerrum and Unmäck, the mean values for the nine determinations are $K_{A}=4.26\times10^{-3}$ and $K_{B}=5.14\times10^{-5}$, with average deviations from the means of 10 and 13.6 per cent, respectively. This unsatisfactory agreement in the literature can be traced, in no small part, to uncertainties inherent in the methods used. Among these, liquid junctions and unrecognized medium effects are sources of error that are eliminated in the method we have just described. The elimination of liquid junction has actually been carried out in this paper, but the complicated and laborious study of the medium effect of glycine has just been begun experimentally.

"It has been demonstrated that the use of silver-silver chloride electrodes or amalgam electrodes leads to identical results in the measurements with alkaline glycine solutions. In the absence of any information concerning the medium effect of glycine, we have drawn, by analogy, upon our study of this subject with acetic and formic acids, and have calculated the activity coefficients of the 0.1 molal amphanion and amphcation in sodium chloride solutions. The logarithms of the activity coefficients are linear functions of the ionic strength, which is in accord with theory. By an exact thermody-

namic method which eliminates the use of liquid junctions and which takes into account certain medium effects heretofore neglected, we have shown that the acid and base constants of an ampholyte may be evaluated. Further, in the case of glycine, the first steps toward an experimental solution have been made, and preliminary values of the important constants determined."

A study of glutathione, II–VI (*Jour. Biol. Chem., 86 (1930), No. 2, pp. 623–634; 87 (1930), No. 1, pp. 55–79; 88 (1930), No. 1, pp. 409–423; 90 (1931), Nos. 1, pp. 25–32; 2, pp. 409–416*).—The first of these papers has already been noted (E. S. R., 63, p. 503).

II. *The determination of reduced glutathione in tissues*, H. L. Mason (pp. 623–634).—In a study of the iodine titration of reduced gultathione it was found that iodide is necessary to make the reaction proceed smoothly. Starch was found preferable to nitroprusside as the indicator.

A new method for the estimation of reduced glutathione in tissues, based on the oxidation of GSH within a narrow range of pH with potassium ferricyanide, is described. Oxidation of sulfhydryl to disulfide occurs with the formation of an equivalent amount of ferrocyanide. The ferrocyanide is estimated colorimetrically by conversion into Prussian blue. "The new method is compared with the iodine titration method. The values found for glutathione in extracts of yeast, liver, and kidneys by titration with iodine are much larger than those found by the new method. Since the latter gives maximal values, the iodine titration is considered as not trustworthy for these tissues. With blood and muscle there is fair agreement between the two methods. Any disagreement in the case of blood is probably due to thioneine."

III. *The structure of glutathione*, E. C. Kendall, H. L. Mason, and B. F. McKenzie (pp. 55–79).—The ethyl ester hydrochloride of glutathione was treated with phenylmagnesium bromide. The peptide alcohol formed was hydrolyzed, and diphenylacetaldehyde was obtained as its azine. "Unless the tripeptide was hydrolyzed during the preparation of the ester, the separation of the azine indicates that the carboxyl group of glycine is free and that the glutamic acid is attached to cysteine." The action upon glutathione of nitrous acid, of sodium hypobromite in alkaline solution, of chloramine-T, and of bromine in acid solution was studied with reference to the bearing of these reactions upon the structure of glutathione, and it was shown that erepsin can hydrolyze glutathione into the three amino acids of the residues of which glutathione is a tripeptide. An improved method for the isolation of glutathione is also described.

"The data obtained show that glutathione is either glutamyl cysteinyl glycine or glutamyl glycyl cysteine. The amino group of the glutamic acid is gamma to the carboxyl group which is substituted."

IV. *Determination of the structure of glutathione*, E. C. Kendall, H. L. Mason, and B. F. McKenzie (pp. 409–423).—Continuing the above investigation, the authors found that "cysteine is not split off from glutathione during the preparation of the ester of the tripeptide in absolute alcohol with hydrochloric acid gas. The ester hydrochloride of glutathione will react with phenylmagnesium bromide and form the Grignard addition product in which the ratio of nitrogen to sulfur is 3 : 1. From the Grignard addition product, diphenylacetaldehyde can be separated. This is evidence that the carboxyl group of the glycine in glutathione is not substituted. In a water solution at 62° the glutamyl grouping of glutathione is completely hydrolyzed from the dipeptide of cysteine and glycine. Only traces of the anhydride of glycyl cysteine are formed under these conditions. The dipeptide of cysteine and glycine prepared by partial

hydrolysis of glutathione with loss of the glutamyl grouping was treated with sodium hypobromite, nitrous acid, and trinitrotoluene. These reactions show that the amino group of the cysteine is free, and that the amino group of the glycine is substituted. . . . Hydrogen peroxide converts the glutamyl grouping of glutathione into succinic acid with a yield of about 20 per cent when the sulfur is in the sulfhydryl form. Glycine can not be recovered after treatment with hydrogen peroxide. When glutathione is in the form of its sulfonic acid derivative, hydrogen peroxide will convert a much higher percentage of the glutamyl grouping into succinic acid and a large amount of the glycine may be recovered. The sulfhydryl group exerts a marked influence on the course of the oxidation with hydrogen peroxide."

From these data it is concluded that "the structure of glutathione is glutamyl cysteinyl glycine." The same conclusion was reached practically simultaneously by Nicolet (E. S. R., 65, p. 11).

V. *The spontaneous cleavage of glutathione in aqueous solution*, H. L. Mason (pp. 25–32).—"When glutathione is kept in aqueous solution at 37–62° [C.], it undergoes cleavage into pyrrolidonecarboxylic acid and cysteinyl-glycine. The pyrrolidonecarboxylic acid is a primary product of this cleavage. It is suggested that this formation of pyrrolidonecarboxylic acid may well be the first step in the synthesis of proline. With Sullivan's test[3] for cysteine, cysteinyl-glycine gives a purplish red color which is distinct from that given by cysteine. If the color is faint, however, it can not be distinguished from the color due to a very small quantity of cysteine. It is suggested that this behavior of cysteinyl-glycine has led Meldrum and Dixon[4] to attribute to cysteine a catalytic activity in the auto-oxidation of glutathione which is probably due to cysteinyl-glycine. Erepsin does not attack glutathione directly but hydrolyzes the cysteinyl-glycine when the glutamyl radical has been broken off as pyrrolidonecarboxylic acid. The glutathione molecule is in this way completely broken up with the liberation of only one carboxyl group."

VI. *The preparation of oxidized glutathione*, H. L. Mason (pp. 409–416).—It was found that "by aeration at pH 7.6 glutathione is quantitatively converted into the oxidized form without loss of nitrogen or sulfur. The isolated preparation when dehydrated with alcohol contains approximately 2 molecules of alcohol for each molecule of the oxidized glutathione. The alcohol is held with great tenacity and has not yet been successfully removed to yield a pure preparation. However, the nitrogen content can safely be used as a measure of the amount of oxidized glutathione present."

The thermodynamic properties of weak acids and bases in salt solutions, and an exact method of determining their dissociation constants, H. S. HARNED and B. B. OWEN (*Jour. Amer. Chem. Soc., 52 (1930), No. 12, pp. 5079–5091, figs. 3*).—In a contribution from Yale University the authors report experiments in which by the use of the extrapolation function ($\log k' - \sqrt{\mu'}$) the dissociation constants of acetic acid and of formic acid were evaluated from measurements of cells without liquid junctions. "This method is thermodynamically sound, and employs no extrathermodynamical postulates. The accuracy of the numerical values obtained depends entirely upon the validity of the empirical extrapolation function used and the accuracy of the experimental data." It is demonstrated that "it is possible, from measurements of cells without liquid junction, to evaluate the thermodynamic behaviors of weak acids and bases in salt solutions, and to determine their dissociation constants by a method which is thermodynamically exact."

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[3] Pub. Health Rpts. [U. S.], 44 (1929), No. 24, pp. 1421–1428.

Ursolic acid, C. E. Sando (*Jour. Biol. Chem.*, *90* (*1931*), *No. 2*, *pp. 477–495*).—The author of this contribution from the U. S. D. A. Bureau of Chemistry and Soils and of Plant Industry finds that "malol, prunol, and urson are identical, thus confirming van der Haar's conclusions[4] in this respect. The name ursolic acid has been adopted for the substance. The formula for ursolic acid appears to be $C_{30}H_{48}O_3$ and not $C_{31}H_{50}O_3$ as claimed by van der Haar. This conclusion is based on the results of 92 combustions including those of the parent substance and many of its derivatives. The following compounds have been prepared and analyzed: Ursolic acid from three sources, the diacetyl derivative of ursolic acid, monoacetylursolic acid, regenerated ursolic acid, methylursolate, monoacetylmethylursolate, regenerated methylursolate, phthalylursolic acid, phthalylmethylursolate, and phenacylursolate. The averaged values of numerous combustions of these substances agree more closely with the C_{30} formula than with the C_{31} formula. The preparation of monoacetylmethylursolate by treating monoacetylursolic acid with thionyl chloride and boiling this product with methyl alcohol constitutes further confirmatory evidence of the hydroxy acid structure of ursolic acid."

Further observations on the relation of carotene to vitamin-A, B. Ahmad (*Jour. Soc. Chem. Indus., Trans.*, *50* (*1931*), *No. 2*, *pp. 12T–14T*).—A further study of the relationship between carotene and vitamin A is reported in which samples of untreated and hydrogenated palm oils were tested for their degree of color and vitamin A potency, and various colored preparations of vitamin A derived from different sources were fractionated by adsorption on suitable materials and the various fractions tested for their vitamin A value by both colorimetric and biological methods.

The results with palm oil confirm experiments of Drummond, Ahmad, and Morton (E. S. R., 64, p. 503) in showing that the vitamin A activity of palm oil is due entirely to carotene. Spectrographic tests showed the presence of no other color pigment than carotene, and the destruction of carotene during the hydrogenation of the oil or by adsorption with norite or Suchar was accompanied by loss in growth-promoting properties of the substance as source of vitamin A.

Treatment of highly colored cod-liver oils with Suchar and norite to remove the natural pigments had no appreciable destructive effect on vitamin A as shown by biological tests, and the decolorizing fractions gave equally intense blue colors with antimony trichloride.

"The results of these experiments, on the whole, emphasize the fact that the vitamin A activity of vegetable sources is carotene, and that it essentially differs from that of the fish-liver oils. Carotene is easily adsorbed by suitable charcoals and is readily oxidized on their surface. The vitamin A of fish-liver oils is not so readily adsorbed and is much more resistant to oxidation, at least in the natural solvents in which it occurs."

A study of the effect of nitrous acid on vitamins B and G, M. L. Whitsitt (*Diss., Columbia Univ., New York, 1929, pp. 31, figs. 5*).—Essentially noted from another source (E. S. R., 65, p. 311).

Chemistry of vitamin B_2, B. C. Guha (*Nature* [*London*], *127* (*1931*), *No. 3207*, *pp. 594, 595*).—The results of a chemical study of vitamin B_2 in the Lilly Liver Extract No. 343 are summarized briefly, with the conclusion that "if the vitamin is a single chemical entity, it is probably not a base, an acid, or a peptide, but a neutral substance."

The active material was not precipitated by picric acid, benzoyl chloride, nitrous acid, flavianic acid, litharge, or barium hydroxide. It was partially precipitated by neutral lead acetate at pH 4.6 and 7 and to a considerable

[4] Rec. Trav. Chim. Pays-Bas, 43 (1924), No. 6, pp. 542–545; 548, 549.

extent by silver nitrate. It was adsorbed by norite at the natural pH of the aqueous liver extract 4.6, but could not be freed from the charcoal by acid, alkaline, or neutral water-alcohol mixtures or by a dilute solution of saponin. Three extractions with 30 per cent propyl alcohol removed it partially, with a considerable loss of activity. Treatment of the extract with phosphotungstic acid gave an inactive precipitate and a filtrate with slight activity. Esterification with ethyl alcohol left the bulk of the activity in the nonesterified portion. Trypsin was without effect.

Attention is called to certain discrepancies in the stability of vitamin B_2 to heating under pressure in an alkaline medium. "Commercial liver concentrate and commercial yeast extract ('marmite') are both fairly stable to autoclaving at pH 9 at 124° C., while aqueous extracts made from brewer's yeast, fresh ox liver, and ox muscle are markedly unstable under the same conditions. The stability appears to be connected with the presence of certain protective materials in a given fraction. The vitamin is stable to sulfur dioxide, hydrogen peroxide, and ozone."

On the preparation of a concentrated source of the heat-labile vitamin B, free from contamination with the heat-stable factor G, H. M. EVANS and S. LEPKOVSKY (*Jour. Nutrition, 3 (1931), No. 4, pp. 353–374, figs. 12*).—The outer layers of the rice kernel were used as the starting material in this attempt to obtain a concentrate of vitamin B (B_1) free from G (B_2). These consisted of the outer layer, known to the trade as hullers first-break bran and designated by the authors as rice bran No. 1; an inner layer, known as hullers second-break bran and designated as rice bran No. 2; and the innermost layer known to the trade and also designated in the present paper as rice polish. In much of the work reported rice brans Nos. 1 and 2 were combined and referred to as rice bran.

The content of vitamins B and G in each of these layers was determined on a 25 per cent alcohol extract of the material. The heat-stable factor vitamin G was found in low concentration in the outermost layer and decreased still further in the inner layers, while the heat-labile vitamin B was present in high concentration in the outermost layer and decreased only slightly in the inner layers.

Extraction of rice bran and rice polish with 85 per cent alcohol separated vitamins B and G effectively, the former being soluble and the latter insoluble in alcohol of this strength. The process resulted, however, in large losses of vitamin B. Extraction of rice polish first with 25 per cent alcohol and then with 95 per cent alcohol, so that the resulting concentration was 90 per cent, removed most of the heat-stable vitamin G, but at the expense of considerable losses in vitamin B. These losses were somewhat reduced by lowering the concentration of the alcohol to 80 per cent, but the removal of vitamin G was not so complete. With rice polish so little vitamin G was present in the original material that the 80 per cent alcohol fractionation of the 25 per cent extract yielded an extract almost free from vitamin G and very rich in vitamin B. Adsorption of this extract on fuller's earth or other clays removed the last traces of vitamin G, which is not adsorbed to any extent by the clays. Attempts to remove vitamin B from the clay by barium hydroxide, as reported by other workers, were unsuccessful, but the activated clay itself is considered to be an exceedingly potent source of vitamin B free from vitamin G.

Retaining vitamins in tomato juice manufacture, E. F. KOHMAN (*Food Indus., 3 (1931), No. 6, pp. 263, 264, figs. 2*).—Attention is called to the high content of vitamins in tomatoes and to the ease with which vitamin C is destroyed in the usual commercial processes of preparing tomato juice, as shown experimentally by the author and associates (E. S. R., 65, p. 298). It is also

noted that if the juice is submitted to a homogenization process to prevent the separation of pulp from the clear juice less of the insoluble matter can be included and consequently the vitamin A content will be lowered. With these points in mind, suggestions, with accompanying diagram, are given for the construction and operation of apparatus for the manufacture of tomato juice standardized to yield the best possible quality.

The stability of irradiated ergosterol [trans. title], A. WINDAUS and E. AUHAGEN (*Hoppe-Seyler's Ztschr. Physiol. Chem., 196 (1931), No. 3–4, pp. 108–120, figs. 9*).—In order to determine the stability of irradiated ergosterol to heat without the interfering effect of oxidation, ergosterol was irradiated in an elaborate quartz apparatus in which the unchanged ergosterol could be filtered out and the filtrate distributed into various compartments which were subsequently sealed off, all without exposure to air. The irradiated ergosterol in the various compartments was then subjected to different temperatures and examined polarimetrically and spectroscopically.

No differences were observed between the preparations irradiated with magnesium and with mercury light. At ordinary temperatures slight alterations took place which occurred more rapidly at a temperature of 100° C. An increase in rotation was noted, accompanied by an increase in absorption, especially at the maximum of 280$\mu\mu$. Since this was accompanied by only a slight decrease in antirachitic properties, it was concluded that the substance undergoing this alteration was not vitamin D. At higher temperatures other changes occurred affecting the vitamin. After 4 hours' heating at 150°, the rotation increased to 83° and the maximum absorption was shifted to 290$\mu\mu$ with the destruction of antirachitic potency.

The quantitative precipitation of sulfides in buffered solutions, I, II (*Jour. Amer. Chem. Soc., 52 (1930), No. 12, pp. 5135–5145, figs. 2*).—The two methods outlined are here reported from the University of Maryland.

I. *Cobalt sulfide*, M. M. Haring and M. Leatherman (pp. 5135–5141).—The controlled precipitation of cobalt sulfide is thus described:

"Prepare an aqueous solution containing about 0.2 gm. of cobalt, preferably as chloride. Free acid should be absent. Add 25 cc. of 0.4 N ammonium acetate, 4.5 cc. of 6.8 N acetic acid, and 70 cc. of water. Heat to boiling in a 300-cc. Erlenmeyer flask, remove from flame, wash down and saturate with hydrogen sulfide under slight pressure until the solution has reached room temperature (45 minutes suffices). Do not agitate for at least 5 minutes at the start. Afterward swirl around occasionally. Pour most of the mother liquor and precipitate through a 9-cm. fluted ashless filter paper. Use the filtrate to wash out the flask and pour this and any remaining precipitate through a 3-cm. fluted ashless filter. Do not wash unless nonvolatile materials are present. In this case wash with a buffer solution made up as above saturated with hydrogen sulfide and cobalt sulfide. Dry the filters in the larger funnel at 100°, fold, and transfer over white glazed paper to a small porcelain crucible. Burn off filter paper by heating strongly on a quartz plate. Transfer to a weighed porcelain boat, wiping out crucible and funnel with a shred of filter paper and place in furnace. Draw air slowly through the combustion tube and start the furnace. Roast for one-half hour after the tube glows dull red. Remove tube from furnace without cooling the latter and allow to cool for 3 minutes. Pass hydrogen through slowly for several minutes and replace in furnace. Heat to 1,000° for 15 minutes and remove from furnace, the hydrogen being allowed to flow until the tube is quite cold. Weigh boat and metallic cobalt."

With respect to the principle of this procedure it is noted in part that "the pH value selected for the quantitative precipitation of cobalt sulfide should be

as low as is consistent with complete and fairly rapid precipitation. At pH 3.93 these conditions were met. The precipitation is complete in less than 1 hour and the precipitate compact and granular so that only a very small filter is needed."

II. *Nickel sulfide*, M. M. Haring and B. B. Westfall (pp. 5141–5145).—The precipitation of nickel with its subsequent determination as the oxide is directed to be carried out as follows:

"A definite quantity of the material is weighed so as to give approximately 0.2000 gm. of nickel. This is dissolved in 10–15 cc. of water, the pH is *adjusted to 4.4 (the desired value) by adding 34 cc. of 0.4* N *ammonium* acetate and 2.8 cc. of 6.8 N acetic acid. The solution is then made up to a volume of approximately 90 cc. This is heated in the Erlenmeyer flask to about 90° (not to boiling). It is then connected with a source of hydrogen sulfide and the air expelled by the gas. After about 5 minutes the flask is rotated vigorously to aid precipitation by stirring. After precipitation the temperature is raised to 60° by heating on a water bath. During this time it is connected to the generator. Precipitation is complete in slightly less than an hour. The solution is filtered from the precipitate by suction, using a Gooch crucible. It is very necessary that the crucible be kept full of liquid until this is complete, i. e., until all the liquid and precipitate have been added. The crucible is then placed in the cold furnace and heated to 1,000°, while a good current of air is drawn through, after which the crucible is cooled and weighed."

In the study of the effect of H-ion concentration on the precipitation of nickel sulfide it was found that "even at pH 7 there is no diminution in precision. The curve reveals that the optimum pH for nickel sulfide precipitation, i. e., the lowest pH consistent with complete precipitation and reasonable time for the same is 4.4."

Determination of soil moisture by the method of multiple electrodes, W. H. McCorkle (*Texas Sta. Bul. 426 (1931), pp. 20, figs. 6*).—The physical and mathematical theory of the multiple electrode method for the elimination of contact errors from the measurement of soil resistivity is developed, the construction and use of the necessary apparatus is described, results of a number of determinations are given, and conclusions including the following are stated.

It was found that in addition to the elimination of contact errors, the multiple electrode method "removes also the necessity of considering the resistance *of lead wires and increases the accuracy of the resistance measurements.*

"Use of the equation relating soil moisture and resistivity enables easy calibration of the apparatus for different locations. The change of salt content of soils throughout a period of time has not been determined, and it is not known if the change would require frequent calibration of the apparatus. Data from the apparatus used on the control plats show that the change of salt content of the soil at the Spur Substation is not rapid enough to require more than one or two calibrations during a year. This would probably not be the case with irrigated or fertilized soils. The small amount of data obtained after completing the installation of the apparatus does not permit definite conclusions to be reached, but indicates that the method can be used successfully to measure relative moisture contents and with further development may be used to measure the percentage of moisture in soils at various locations."

The estimation of salt and molasses in mixed feeds, G. S. Fraps (*Texas Sta. Bul. 425 (1931), pp. 12*).—Salt was estimated by calculating total chlorides as sodium chloride, molasses by determining total sugars after inversion and calculating from the invert sugar figure on the assumption that the molasses will "furnish 50 per cent of its weight as invert sugar" at least.

For the chloride determination comparison was made of two methods, the first being that previously noted (E. S. R., 45, p. 14). The second and preferred method consists in extracting with a picric acid solution, the precipitation of proteins by this reagent serving in place of the clarification required in the first procedure, the extraction being followed by neutralization of the extract with calcium carbonate and titration of an aliquot from the filtered solution with silver nitrate, potassium chromate as indicator. The sugar determination for the molasses estimation involves essentially the standard procedure.

Bleaching and dyeing Royal Ann cherries for maraschino or fruit salad use, D. E. BULLIS and E. H. WIEGAND (*Oregon Sta. Bul. 275 (1931), pp. 29, figs. 5*).—The bulletin contains recommendations with respect to the harvesting, handling, bleaching, and dyeing of cherries intended for treatment by the maraschino process and presents the results of a study of the action of various bleaching and hardening agents with the 1929 and 1930 crops.

"For general use sulfur dioxide solutions are recommended for bleaching cherries, but under certain conditions sodium sulfite solutions may be employed. Calcium carbonate (precipitated chalk or whiting) was found superior to hydrated lime as a hardening agent. Hardening and reduction of cracking are aided by small amounts of tannic acid, magnesium sulfate, and calcium sulfate. Maturity is an important factor from the standpoint both of cracking losses and of quality of finished product. Immature fruit cracks in the bleach liquor to a less extent and is more resistant to bruising and similar injury than mature cherries."

The effect of various hardening materials and dyeing procedures on the finished cherry is discussed, together with methods for determining the strength of bleaching solutions.

METEOROLOGY

Relationship between precipitation in valleys and on adjoining mountains in northern Utah, G. D. CLYDE (*U. S. Mo. Weather Rev., 59 (1931), No. 3, pp. 113–117, figs. 3*).—From a comparative study by the Utah Experiment Station of the amount and distribution of precipitation at different places in the Cache Valley at an average elevation of 4,400 ft. and in the adjacent mountains above 8,000 ft., the author concludes that "precipitation on the valley floor of Cache Valley varies widely, increasing with elevation from the bottom of the valley floor to the foothills. The average spring and summer precipitation for the 18 valley stations equaled approximately 45 per cent of the total annual precipitation. The summer precipitation at the valley stations is spotted, while the winter precipitation is more uniform. Summer precipitation above 8,000 ft. is extremely spotted. There seems to be no fixed relationship between the valley and mountain precipitation during the summer season. Winter precipitation on high mountain watersheds is measured by snow surveys. It is quite uniform over wide areas. The water equivalent of the accumulated snow cover on high watersheds is several times the valley precipitation during the period of accumulation. Existing records indicate that during the winter season for northern Utah watersheds there is no relationship between valley and mountain precipitation. Valley precipitation is a poor index of the probable water supplies and at times may be misleading. Mountain precipitation measured above 8,000 ft. elevation seems to be a good index of stream flow from that area."

Rocky Mountain snowfall and the subsequent spring and summer weather (*Bul. Amer. Met. Soc., 12 (1931), No. 6–7, pp. 126, 127*).—This is an abstract of an unpublished manuscript by E. A. Beals on the Effect of Snow in

the Northern Rocky Mountains on the Weather, which indicates that "the effect of light or heavy snow cover, over the northern Rocky Mountain region, *might be interpreted . . . as being rather general over* a considerable region extending from Portland, Oreg., which is west of the mountains, to the upper Mississippi Valley, principally in the months of March and April. The effect of light winter snowfall is reflected in high spring temperatures and below normal precipitation, and heavy winter snowfall with low spring temperatures and precipitation above normal."

Study of the yearly variations of temperature and barometric pressure over the west Pacific, S. CHEVALIER (*Proc. 4. Pacific Sci. Cong., Java, 1929, vol. 2–A, pp. 427–447, figs. 4; Eng. abs., pp. 427, 428*).—From a study of observations at Zi-ka-wei, China, for 53 years, 1873–1926, evidence was obtained of "(1) clear signs of a 4-year period; (2) a slow falling of the barometric pressure at Zi-ka-wei from 1884 to 1923 or nearly so, with a corresponding rise of the temperature." No evidence was obtained of a 7-year period, nor of positive correlation between barometric pressure and temperature and sun spots.

The article is in French.

Frost penetration, O. L. FASSIG (*Bul. Amer. Met. Soc., 12 (1931), No. 6–7, pp. 116–118*).—This is the author's abstract of a paper presented at a meeting of the American Meteorological Society, May 4, 1931.

A study of 1,300 replies by Weather Bureau observers to an inquiry as to the depth to which frost usually penetrates and the extreme depths observed "indicates the close relation existing between the mean winter temperature and the depth of the frost level. The line of no frost and the mean winter isotherm of 55° follow closely the southern limits of the United States and the Pacific coast to northern California; the line of 50 in. of frost penetration extends from the Canadian border in Minnesota and North Dakota eastward, closely following the parallel of 45° of north latitude, while the isotherm of mean winter temperature of 5° passes over the northern portion of Minnesota and northeastern portion of North Dakota. The rate of increase in the depth of the frost line is roughly 1 in. for every 25 miles from the Gulf northward and from the Pacific coast toward northern Minnesota; the rate of decrease in the mean winter temperature is roughly 1° F. per 25 miles from the Gulf and from the Pacific coast to the northern portion of Minnesota."

Weather and corn yields, W. A. MATTICE (*U. S. Mo. Weather Rev., 59 (1931), No. 3, pp. 105–112, figs. 8*).—This article reports a study, by the Kincer method, of the relation of weather (temperature, precipitation, humidity, and sunshine) to yield of corn in different States of the Corn Belt for the period 1901–1925, including a comparison of computed and actual yields.

The coefficients of correlation are shown to be "fairly high, ranging from 0.71 for Iowa to 0.92 for Kansas." Relative humidity appears to be a controlling variable in Kansas. "Undoubtedly, the relative humidity at the p. m. observation is a fairly good index of the weather conditions as affecting corn, at least in the Plains States. The moisture conditions are more precarious here than farther east, and anything which tends to increase evaporation would necessarily produce its effect on crops." The agreement between computed and actual yields is as a rule very close for the Corn Belt as a whole. "The coefficient of correlation between these values is 0.89, a value sufficiently high to justify the statement that yields are largely dependent on the weather." With regard to Iowa, however, the author's results tend to confirm Reed's conclusion (E. S. R., 58, p. 808) that as a result of breeding for yield without regard to maturity "there is a well-defined tendency for corn in Iowa to

become more and more damaged by frost before it reaches maturity," and the belief is expressed that "the production of this crop will need to reach a more settled state than at present before valuable forecasting can be done from weather conditions."

Monthly Weather Review, [March–April, 1931] (*U. S. Mo. Weather Rev., 59 (1931), Nos. 3, pp. 97–137, pls. 16, figs. 17; 4, pp. 139–173, pls. 10, figs. 5*).—In addition to detailed summaries of climatological data and weather conditions for March and April, 1931, solor and aerological observations, and bibliographical and other information, these numbers contain the following contributions:

No. 3.—Notes on Lake Levels (illus.), by J. W. Shuman (pp. 97–105); Weather and Corn Yields (illus.), by W. A. Mattice (pp. 105–112) (see p. 617); Relationship between Precipitation in Valleys and on Adjoining Mountains in Northern Utah (illus.), by G. D. Clyde (pp. 113–117) (see p. 616); The Green Flash Observed October 16, 1929, at Little America by Members of the Byrd Antarctic Expedition, by W. C. Haines (pp. 117, 118); A Field Albedometer (illus.), by N. N. Kalitin (p. 118); Observing the Weather at Mount Evans, Greenland, by L. R. Schneider (pp. 118–120); and Subsoil Moisture and Crops for 1931, by H. C. Snyder (p. 120).

No. 4.—A Five-year Record of Lightning Storms and Forest Fires (illus.), by H. T. Gisborne (pp. 139–150); The Calendar Year as a Time Unit in Drought Statistics (illus.), by A. J. Henry (pp. 150–154); Solar Radiation Intensities within the Arctic Circle (illus.), by H. H. Kimball (pp. 154–157); and Rain-gage Funnels of Different Depths, by J. Glasspoole (pp. 157, 158).

SOILS—FERTILIZERS

The chemical composition of some chernozem-like soils of North Dakota, T. H. Hopper, L. L. Nesbitt, and A. J. Pinckney (*North Dakota Sta. Bul. 246 (1931), pp. 72, figs. 11*).—The soils of Cass and McHenry Counties, considered representative of those of the eastern half of the State, are described as "characteristically different from other American soils. They are geologically young and have been developed under climatic conditions existing in a zone that includes approximately the eastern half of North Dakota and the eastern third of South Dakota in the United States. They may be considered as resembling the chernozems."

Of these soils, samples from selected areas were analyzed for silicon dioxide, titanium oxide, aluminum oxide, ferric oxide, manganese oxides, sulfur trioxide, phosphoric acid, calcium oxide, potassium oxide, sodium oxide, carbon dioxide, loss on ignition, organic carbon, and nitrogen, the samples being drawn from surface (0 to 7 in.), subsurface (7 to 20 in.), and subsoil (20 to 40 in.).

The results indicated that in general the soils examined are calcareous, though the carbonate content of the surface soil was in many cases quite low. Organic matter content from the grassland vegetation was found relatively high, the carbon-nitrogen ratio normal for a semiarid region.

"In many instances the ratio of chemical equivalents of calcium and magnesia (Ca : Mg) are relatively narrow. This is particularly true of the surface soils of the Fargo series in Cass County which have a ratio of 0.94, showing a silghtly larger chemical equivalent of magnesium than of calcium. The phosphoric acid content is not recognized as being either low or high. In general the highest percentages occur in the surface soil as a result of the influence of a grassland vegetation. Sulfur is generally present in appreciable quantities and in some instances in large amounts. The percentages of potash and soda are relatively high. This is especially true of soda. Titanium and manganese were present in all soils examined for them. The extremes in percentages of

iron and alumina are not wide when the physical characteristics and the carbonaceous and the calcareous nature of the soils are considered. The calcium salts in and the reaction of the soil solution are such as to tend to keep the soil colloids coagulated and immobile."

[Soil Survey Reports, 1927 Series] (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpts.], Ser. 1927, Nos. 12, pp. 41, pl. 1, fig. 1, map 1; 13, pp. 45, pls. 2, fig. 1, map 1*).—The two surveys here noted were carried out with the respective cooperation of the Ohio and California Experiment Stations.

No. 12. *Soil survey of Butler County, Ohio*, E. D. Fowler and T. C. Green.—Butler County, in southwestern Ohio, contains 298,240 acres of lands of varying topography and provided with good natural surface drainage by the Miami River and its tributaries.

Of the soils of the area surveyed, Russell silt loam making up a total of 53.2 per cent of the land surface of the county is the most extensive, followed by 16.8 per cent of Fincastle silt loam, together with 27 other types of 18 series and 0.5 per cent of river wash.

No. 13. *Soil survey of the Clear Lake area*, California, E. J. Carpenter et al.—The Clear Lake area, northwestern California, has an extent of 247,040 acres, is mostly mountainous, and is for the most part well drained.

Rough mountainous lands and rough stony lands, 43.2 and 7.6 per cent, respectively, of the area surveyed are most prominent among the soils listed, but the area contains also agricultural soils amounting to 23 types of 14 series. Of these the most extensive is 7.1 per cent of Hugo clay loam.

The measurement of the degree of saturation of soils with bases, R. H. Walker, B. J. Firkins, and P. E. Brown (*Iowa Sta. Research Bul. 139 (1931), pp. 153–176, figs. 10*).—This bulletin reports experiments to ascertain the relative accuracy of the various methods available for the determination of replaceable bases, replaceable hydrogen, and base exchange capacity in soils. An electrodialysis of 100 gm. of soil continued for 45 hours in the Mattson (E. S. R., 56, p. 115) cell gave results which "seemed satisfactory when compared with the data secured with other methods." In the case of a smaller soil sample (10 gm.), however, either in the Mattson or in the Bradfield (E. S. R., 58, p. 717) cell "the end point was not definite and the results could not be considered accurate. Furthermore, there was a continued extraction of basic materials from the soil after more bases had been removed by electrodialysis than were known to be present in a replaceable form in the soil. Hence, it appears that the error in this method may be greater than that caused by solubility effects in the leaching methods." The electrodialysis work was conducted in general in accordance with the procedure of Humfeld and Alben (E. S. R., 58, p. 717).

The Hissink method (E. S. R., 50, p. 118) for the same determinations was also given trial, but preference was finally given to the method of Parker (E. S. R., 60, p. 112). "The principle of this method has been well established, and the method has been used, with certain modifications in technic, by other investigators. After the replaceable hydrogen and base exchange capacity are determined by the Parker method, the amount of replaceable bases and the degree of saturation with bases may be calculated. This method has been tested on a number of Iowa soils and on soils treated with various amounts of lime of different degrees of fineness. In all cases satisfactory results have been secured. In general it is evident that of all the methods tested that proposed by Parker seems to give the best picture of the actual condition of the base exchange complex in soils. Certain modifications in the technic of this method have been suggested for future work."

Nitrogen and organic matter in the soil, A. F. Gustafson (*N. Y. Agr. Col. (Cornell) Ext. Bul. 201 (1930), pp. 18, figs. 12*).—The bulletin presents a semi-popular discussion of the organic matter problem as it appears in the case of New York State soils.

"Liming, where lime is needed, is the first step; fertilizing, particularly the addition of phosphorus, is the second; growing legumes is the third; and feeding the crops to livestock and applying the manure to the land with minimum loss is the fourth big factor in economic crop production. All of these practices have to do with maintaining and increasing the organic matter and the nitrogen supply of our soils. Returning all possible crops residues, growing catch and cover crops, and turning under green manure crops in their economic place, and practicing a good rotation are important aids in supplying organic matter and nitrogen for crops."

A soil management program for Grundy silt loam, W. H. Stevenson, P. E. Brown, et al. (*Iowa Sta. Bul. 280 (1931), pp. 165–184, figs. 2*).—Recommendations based on results secured on 13 cooperative soil experimental fields in southern Iowa and specific for the soil type under consideration are given in part as follows:

"A legume should always be included in the rotation to provide organic matter and nitrogen. Farm manure increases the yields of crops grown on this soil and is distinctly profitable. It is undoubtedly the most profitable fertilizing material which can be employed. Beneficial effects also follow the use of crop residues, especially legume residues. The use of legumes as green manures and the turning under of a part or all of the crop would be of large value in many cases. Farm manure and leguminous green manures will add nitrogen and organic matter to the soil and provide for the most satisfactory yields of crops.

"The Grundy silt loam is acid in reaction, and for the best growth of general farm crops, particularly legumes, lime must be applied. The soil should be tested and the proper amount of lime added preceding the legume crop. Some legumes will not grow satisfactorily on an acid soil. The beneficial effect of liming appears very definitely on the legumes, but the grain crops are also often benefited. Sometimes corn and oats show very large increases. The profit from the use of lime on this soil is large.

"Phosphate fertilizers should be applied to the Grundy silt loam. . . . Either rock phosphate or superphosphate may be employed to advantage. In some cases superphosphate seems to give somewhat larger yields, but in other instances the rock phosphate has proven quite as desirable. In general superphosphate may be expected to give somewhat quicker results, having immediate beneficial effects. Rock phosphate, on the other hand, usually gives a larger effect the second year after application than in the first year. . . . In some cases a commercial potassium fertilizer might be used with value on this soil, especially for certain crops. . . . The use of commercial nitrogenous fertilizers can not be recommended on this soil at present. Ordinarily the nitrogen needed may be more cheaply and quite as satisfactorily secured by the use of a leguminous crop as a green manure."

Chemical analyses of pineapple soils, O. C. Magistad, J. M. Horner, and L. A. Dean (*Pineapple Quart. [Hawaii. Pineapple Canners' Sta.], 1 (1931), No. 1, pp. 39–45, fig. 1*).—Silica, titanium oxide, aluminum oxide, ferric oxide, manganese dioxide, calcium oxide, magnesium oxide, potassium oxide, sodium oxide, and phosphoric anhydride figures are given, together with those for carbon, nitrogen, organic matter, and loss on ignition, in the case of a group of 11 soils. In 10 of these soils the exchangeable bases were also determined.

Fertilizer tests of several soil types, T. L. Lyon (*New York Cornell Sta. Bul. 520 (1931), pp. 19, figs. 4*).—The types of soil selected for the experiment were Ontario loam, Volusia silt loam, Dutchess silt loam, and Vergennes clay. Of these soil types four samples each of the first two and two each of the remaining types, amounting in each case to between 9 and 10 tons of soil and subsoil to a depth of 3 ft., were obtained from different parts of the State.

The samples, which were taken from quite widely separated locations, were brought to the station and placed in galvanized iron rims imbedded in the ground to a depth of 3 ft., the lime and fertilizer treatments to be tested being applied to the soil in different rims. "The soil samples were cropped for a number of years, during which period the same fertilizer treatments were accorded all of them. The lime treatments were different for each sample and were based on a lime requirement test of each sample. When no lime or fertilizer was applied to the soils the productivity of the respective types varied greatly. The Ontario and Vergennes soils were most productive, while the Volusia and Dutchess samples yielded considerably less than half as much as either of the others.

"The addition of rather heavy applications of complete fertilizer to the unlimed soils produced some large increases in yield. The actual increases were greater for the soils that yielded most without lime or fertilizer, namely the Ontario and Vergennes. The addition of lime without fertilizer caused the Ontario samples to decrease slightly in yield. The Vergennes soil derived only a small benefit from liming, but the Volusia and Dutchess types gave as much response to lime as they did to heavy fertilization without lime. Lime and heavy fertilization caused the Volusia and Dutchess soils to produce as large yields as either the Ontario or Vergennes types. This shows the high potential fertility of the former types when placed under favorable conditions. . . . Applications of lime with no fertilizer tended to make the yields somewhat more uniform, although the Volusia samples still showed considerable variation. It was on the rims treated with both lime and heavy fertilization that the greatest uniformity was maintained. . . .

"Tests of the soil samples with and without phosphorus in the fertilizer indicate that Ontario loam needs liberal fertilization with phosphorus, and that the Volusia soil will respond in lesser degree. . . . Fertilization with potassium had little effect on the Ontario samples. If farm manure were to be used liberally it is probable that it would supply the needs of this soil for the common field crops. . . . The Dutchess samples responded well to potassium, but the Vergennes showed little need for this fertilizer constituent. All of the soil types responded strongly to nitrogen. Ontario gave the greatest response and Volusia the least. The better types made the greater response to nitrogen. A crop of red clover once in a crop rotation covering five years did not furnish the soil with sufficient nitrogen to produce as large crops as these soils are capable of producing if enough nitrogen is supplied. Farm manure or some commercial carrier of nitrogen is needed for intensive crop production, especially on the better soils."

Investigations relative to the use of nitrogenous plant-foods, 1913–1927, J. G. Lipman, A. W. Blair, and A. L. Prince (*New Jersey Stas. Bul. 519 (1931), pp. 46, figs. 8*).—The bulletin presents and discusses the data for the 15 years 1913–1927 of the stations' cylinder experiment begun in 1898 and last reported upon in 1916 (E. S. R., 35, p. 123). In general the results confirm those noted in detail from the previous report, especially with respect to the superiority of sodium nitrate over equivalent quantities either of ammonium sulfate or of dried blood.

"The percentage of nitrogen for a given crop varies more or less from year to year, but the fertilizer and lime treatments do not appear to have had a pronounced influence in this respect. Extreme treatments have usually resulted in a high percentage of nitrogen in the dry matter. Where lime was used the recoveries with nitrate of soda were usually higher than where both nitrate and manure were used. Without lime the recoveries with both nitrate of soda and sulfate of ammonia were poor for the last two 5-year periods. Where nitrogenous fertilizers were used in combination with manure, the recoveries were usually about 25 to 45 per cent of the applied nitrogen. . . . Excessive applications of nitrogen generally mean a heavy loss of nitrogen and consequently lowered recoveries. This probably explains the comparatively low recoveries where manure is used. . . .

"Where nitrate of soda has been used without manure, lime has had a very pronounced beneficial effect. In some cases where no lime has been used the yields have dwindled to practically nothing, whereas with lime and with lime and green manure, yields have been well maintained. Where no nitrogen has been applied the percentage of nitrogen in the soil has been reduced until now it is little more than half what it was originally. Where minerals and nitrogenous fertilizers have been used without manure, the percentage of nitrogen in the soil is now little more than in those soils where no nitrogen has been applied. Where manure alone or manure and nitrogenous fertilizers have been used as the only source of nitrogen, the nitrogen content of the soil has been fairly well maintained, and in a few cases it is now about what it was in the original soil." It has been better maintained on the green manure cylinders than on those without the last-named treatment.

Rate of decomposition of pineapple plants, O. C. Magistad (*Pineapple Quart.* [*Hawaii. Pineapple Canners' Sta.*], *1* (*1931*), *No. 1, pp. 2–7*).—Finely ground pineapple stems were found to be completely decomposed in three months in soils kept at 30 per cent moisture content (moisture equivalent 36.4 per cent) in all cases, whether nitrogen was added or not. The water-soluble nitrogen balance at the end of two months showed that a considerable loss of this form of nitrogen had occurred. The loss of water-soluble nitrogen was greatest where the most nitrogen was available. The quantity of nitrogen needed to decompose 1.31 per cent of dry pineapple stems, roughly equal to 15 tons per acre-foot, would seem to be about 40 to 80 parts per million, which is equal to from 100 to 200 lbs. of nitrogen per acre. "Some of this may be furnished by leaf nitrogen in practice." The quantity of organic matter decomposed seemed to be greatest in the soils receiving the most water-soluble nitrogen.

Analyses of the organic matter in soils showed the fat content to be greatest where the greatest decomposition occurred. It is believed that this soil fat is the fat of the bodies of soil organisms, the largest numbers of which occur in the soils receiving the most nitrogen.

An attempt to compost pineapple plant residues, O. C. Magistad and F. A. E. Abel (*Pineapple Quart.* [*Hawaii. Pineapple Canners' Sta.*], *1* (*1931*), *No. 1, pp. 7–10*).—Report is made of an experiment showing the possibility of composting shredded pineapple plant residues successfully with the aid of a nutrient mixture made up of ammonium sulfate 45 per cent, superphosphate 15 per cent, and limestone 40 per cent. This mixture was applied in layers alternating with those of the material to be decomposed at the rate of about 100 lbs. to each 1,000 lbs. of the shredded trash. Decomposition was considered complete in about 6 months. Analysis of the compost showed that most of the mineral matter had been leached away in the process, which was carried on

with a dirt floor. With a moisture content of 70 per cent, the total nitrogen was 0.66 per cent.

AGRICULTURAL BOTANY

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Effect of abnormally long and short alternations of light and darkness on growth and development of plants, W. W. Garner and H. A. Allard (*Jour. Agr. Research [U. S.], 42 (1931), No. 10, pp. 629–651, figs. 6*).—Breaking the continuity of the daily illumination period of plants by darkening them in the middle of the day failed to affect reproductive activity to a degree at all comparable with that produced by excluding light at the beginning or close of the day. Further breaking up of the daylight period apparently accentuated the lack of effectiveness in influencing the behavior of the plant. When plants were completely darkened on alternate days during summer, supplying about 15 hours of light and 33 hours of darkness, the effects were those of a short day but less potent. Alternate exposure to a 10-hour and a full summer day was intermediate in effect in respect to the initiation of flowering.

Alternation of light exposure in periods ranging from 6 hours down to 5 seconds in artificially lighted chambers caused malnutrition and retarded growth, increasing in intensity with the shortening of the exposure. The effects of the alternation included etiolation, apparent destruction of the chlorophyll, localized dying of leaf tissue, attenuation, and decrease in stem elongation and production of dry matter, irrespective of whether the subject was a short- or a long-day plant. Cutting the light interval to one-half the darkness interval intensified the unfavorable effects and culminated in death. Increasing the light to twice the darkness interval improved the condition of the plant. In general, all alternations from 6 hours downward favored the flowering in long-day plants but were unfavorable to short-day plants.

Internode growth [trans. title], K. Bernheim (*Bot. Centbl., Beihefte, 46 (1930), 1. Abt., No. 3, pp. 347–406, figs. 10*).—All data are said to show close correlations to exist between the individual organs investigated.

Plant material introduced by the Division of Foreign Plant Introduction, Bureau of Plant Industry, October 1 to December 31, 1929 (Nos. 81620–82599) (*U. S. Dept. Agr., Inventory 101 (1931), pp. 48*).—Brief descriptive notes are given on a total of 980 lots of plants and seeds introduced into the United States for experimental purposes and general testing.

Glossary of botanical terms commonly used in range research, compiled by W. A. Dayton (*U. S. Dept. Agr., Misc. Pub. 110 (1931), pp. 40, figs. 76*).—Definitions are presented for a large number of botanical terms.

A device for aseptic distribution of culture media, W. L. Mallmann (*Amer. Jour. Pub. Health, 21 (1931), No. 3, p. 288, fig. 1; abs. in Michigan Sta. Quart. Bul., 13 (1931), No. 4, p. 223*).—It is stated that the glass cone used for shielding the filling tip of the apparatus employed in distributing culture media aseptically into test tubes has never been satisfactory because it is liable to breakage. A copper piece plated with nickel or with chromium is described in the original article.

GENETICS

The "concept of organism" and the relation between embryology and genetics, I–III, J. H. Woodger (*Quart. Rev. Biol., 5 (1930), Nos. 1, pp. 1–22; 4, pp. 438–463, figs. 7; 6 (1931), No. 2, pp. 178–207, figs. 2*).—An attempt to clarify the scientific concepts of embryology and genetics.

On development and heredity [trans. title], G. Ekman (*Ann. Soc. Zool. Bot. Fennicae Vanamo, 10 (1930), pp. 1–141, figs. 29; Finn. abs., pp. 140, 141*).—A theoretical discussion.

The phylogeny of maize, G. N. Collins (*Bul. Torrey Bot. Club, 57 (1930), No. 4, pp. 199–210*).—Evidence on the evolution of corn supplied by taxonomic, cytological, and genetic studies is reviewed, and various hypotheses as to its origin are discussed.

The ontogeny of the maize plant, P. Weatherwax (*Bul. Torrey Bot. Club, 57 (1930), No. 4, pp. 211–219*).—An account of the development of the corn plant.

The genetics of maize, E. W. Lindstrom (*Bul. Torrey Bot. Club, 57 (1930), No. 4, pp. 221–231, fig. 1*).—Activities in the field of corn genetics during the decade 1920–1929, reviewed in this contribution from the Iowa State College, include the inheritance of characters involving the entire plant, the location of characters on chromosomes, mutation phenomena, variegation genes, selective fertilization, and cytogenetical aspects of corn.

Hybrid vigor in wheat (Triticum vulgare), C. E. Rosenquist (*Jour. Amer. Soc. Agron., 23 (1931), No. 2, pp. 81–105, figs. 3*).—To study the degree and prevalence of hybrid vigor consequent upon crossing pure lines of common wheat, F_1 hybrids and their parents were grown side by side at the Illinois Experiment Station and compared in date in pollen, tillers per plant, tillers bearing spikes, plant height, plant weight, grain weight, and spike weight. The material embraced a total of 26 different crosses, including 1,590 hybrid and 2,692 parent plants during the years 1927, 1928, and 1929. The weight of the whole plant minus the roots was considered the best criterion of heterosis, since it is the best measure of the final result of the metabolism of the plant.

The observations on hybrids and parents grown in a 1-in. spacing plat revealed no pronounced examples of hybrid vigor, the differences resembling rather those which would be found in a similar plat planted to fairly similar varieties. Data upon individual plants grown 4 in. apart in the row showed earliness, high tillering ability, numerous spikes per plant, tallness, high yield per plant, and high grain yield to be partially dominant over low values for these characters, which was considered a mark of hybrid vigor. While some degree of increase in F_1 above the parental average or above the high parent was fairly common, the magnitude of this increase was seldom significant. Decreases below the parental average or below the low parent were often shown by the F_1 hybrids. The frequency of such decreases was explained by the assumption that two or three incompletely dominant factors which depress growth are found among pure lines of *vulgare* wheat. The increases in F_1 above the higher parent could be explained by assuming each parent to carry different, partially dominant, favorable growth factors which, combined in the F_1, caused vigor above that of either parent.

Factorial balance in the determination of fruit shape in Cucurbita, E. W. Sinnott and D. Hammond (*Amer. Nat., 64 (1930), No. 695, pp. 509–524, figs. 9*).—Genetic studies at Columbia University have resulted in the isolation of several independent factors tending to flatten fruit shape in Cucurbita, while their allelomorphs produced various elongated shapes. Certain elongate types were evidently not due to factors of this sort but to others which produced elongation directly or inhibited the operation of flattening factors. In certain pure lines of Cucurbita there was apparently one elongating factor, whereas others evidently possessed two or more. A specific fruit shape appeared to be the resultant of a balance between a series of factors differing in the degree and direction of their effect. Shapes phenotypically identical may be genotypically different. It is believed that these shape factors operate through their influence on growth correlations.

Cytological and other features of variant plants produced from X-rayed sex cells of Nicotiana tabacum, T. H. GOODSPEED (*Bot. Gaz., 87 (1929), No. 5, pp. 563–582, figs. 11*).—Having previously reported with Olson (E. S. R., 58, p. 729) large numbers of variant individuals occurring in selfed progeny from X-rayed cells of *N. tabacum purpurea*, the author now reports a more detailed description of the external morphology of certain variant types and particularly of their cytological condition.

It is claimed that appropriate X-ray dosage administered to *N. tabacum* flower buds may condition the appearance of many variants in the selfed progeny. Evidence appeared that variation could be induced by the irradiation of mature pollen. Besides the abscission of all the smaller flower buds, no apparent somatic effect resulted from the X-rayed dosage employed. The X-ray variants showed numerous modification types of all vegetative and floral organs and reduction to various degrees in fertility. Cytologically considered, the variants examined proved to be normal as to chromosome number and behavior, they showed nonconjunction as to one or more chromosome pairs, and they proved to be products of nondisjunctional prenomena and to possess fragmented chromosomes.

Cytoplasmic inheritance of male sterility in Zea mays, M. M. RHOADES (*Science, 73 (1931), No. 1891, pp. 340, 341*).—Investigations at Cornell University of the inheritance of a male sterile line of corn collected at Arequipa, Peru, by R. A. Emerson and F. D. Richey indicated that the sterility is determined entirely by the nonnuclear elements of the maternal gamete. Replacement of the original chromosomes in the male-sterile line with chromosomes from normal lines had no effect on the sterility. By using Mendelian markers (genes) it was shown that at least 9 of 10 linkage groups were free from any factor or factors causing the sterility. Pollen from partially sterile plants apparently carried no transmissible factors, either genic or cytoplasmic, for male sterility. The genetic constitution of the male parent crossed with a male sterile individual had no demonstrable effect on the degree of sterility. The meiotic divisions in microsporogenesis were normal. The degeneration of the pollen occurred usually after the first vegetative division.

A comparative biometric study of albino and coloured guinea-pigs from the point of view of their suitability for experimental use, G. W. DUNKIN, P. HARTLEY, E. LEWIS-FANING, and W. T. RUSSELL (*Jour. Hyg. [London], 30 (1930), No. 3, pp. 311–330, figs. 3*).—The results of a comparative study of the fertility, mortality, and rate of growth of a stock of albino and a stock of cream and white guinea pigs are reported. There were no statistical differences between the two stocks, but it was shown that the period of the year had an important bearing on the various characters. Fewer litters were born, the size of litter was less, and the birth weights were lower for guinea pigs in both stocks born during the quarter January to March, inclusive.

Melanin formation with air exposure at room temperature in the eyes and hair roots of mammals [trans. title], W. SCHULTZ (*Ztschr. Wiss. Biol., Abt. D, Arch. Entwickl. Mech. Organ., 123 (1930), No. 1, pp. 132–152*).—An account is given of pigment formation in the eyes and hair of rabbits carrying factors in the albino series. Pieces of skin were placed in Petri dishes, and the time and temperature required for pigment formation were recorded. By measuring the temperature and time required for color formation it was possible to determine the grade of the albino series in which the allelomorphs belonged. Attention is called to the general distribution of this multiple allelomorphic series in various animal species.

The dependence of the pigmentation, form, and growth of feathers on *thyroid function in the domestic fowl* [trans. title], E. Schwarz (*Ztschr. Wiss. Biol., Abt. D, Arch. Entwickl. Mech. Organ., 123 (1930), No. 1, pp. 1–38, figs. 18*).—The relation of the thyroid to feather growth and character was investigated from a histological study of the character of the embryonic thyroid, descriptions of two cases of spontaneous hypothyroidism, observations of the results obtained in the transplantation of thyroid tissue in day-old chicks, and in thyroidectomy experiments. In influencing feather formation it appears that the thyroid is closely related to the gonads, especially as regards form and pigmentation in the secondary sex characteristics of the feathers.

The regulation of the ovarian cycle, M. Hill (*Sci. Prog. [London], 25 (1931), No. 99, pp. 449–464*).—In discussing the mechanism regulating the ovarian cycle, the author cites evidence to indicate that the regulation is outside the ovary and apparently located in the anterior lobe of the hypophysis. Two distinct effects are produced in the ovary by secretions of the anterior lobe, i. e., luteinization of the follicle and suppression of oestrous, and ovulation with the accompanying oestrous changes. These two effects are thought to be due to two different hormones. Suggestions for the cyclic reactions of the ovary are discussed, especially the possible storage of the hormones in the hypophysis and the reciprocal action of the secretions of the gonads on the pituitary.

The intermediate stages of sexuality, R. Goldschmidt (*Die Sexuellen Zwischenstufen. Berlin: Julius Springer, 1931, pp. X+528, figs. 214*).—The author sets forth examples from a wide variety of invertebrate and vertebrate animals supporting his theories of intersexuality and sex reversals based on the interaction of sex-determining substances varying in strength.

FIELD CROPS

Plot arrangement and sampling, J. Stanley (*Pineapple Quart. [Hawaii. Pineapple Canners' Sta.], 1 (1931), No. 1, pp. 19–26, figs. 16*).—Pointing out that there are three general methods of diminishing the probable error in experimental work, namely, (1) extra care and refinement, (2) increase in the number of observations, and (3) the elimination of external chance influence due to a nonhomogeneous experimental environment, the author discusses the third, particularly as concerns the arrangement of the plats and the manner of taking samples. Among items considered are the use of the Latin square method of plat replication, the distribution of check plats, and the size of samples necessary to give results.

A modification of Delwiche's system of laying out cereal variety test plats, K. H. Klages (*Jour. Amer. Soc. Agron., 23 (1931), No. 3, pp. 186–189, figs. 2*).—The Delwiche plan for laying out cereal variety test plats (E. S. R., 60, p. 34) was modified at the South Dakota Experiment Station so that only two instead of six drill rows were grown in the alleys between adjacent plats. The modified plan was found practical for South Dakota conditions in so far as it eliminated the need for cultivated alleys between plats, cut down border effects, and reduced possibilities of exaggerated yields.

A statistical study of wheat and oat strains grown in rod-row trials, F. R. Immer and E. R. Ausemus (*Jour. Amer. Soc. Agron., 23 (1931), No. 2, pp. 118–131*).—Statistical study of material from uniformly replicated rod-row trials of hard red spring wheat, durum wheat, and oats grown at the Minnesota Experiment Station and at the Waseca, Crookston, and Morris Substations showed plumpness of grain to be closely associated with yielding ability, while the relationship between date of heading and yield varied with the

crop, the year, and the station. Stem and leaf rust reaction were correlated negatively with yield in hard red spring wheat in most comparisons, and crown rust infection was associated negatively with yield in oats.

The strains tested for several years sometimes yielded comparably in successive years, and sometimes the yields one year showed little or no relationship to those in the next year. Reaction to stem and leaf rust in wheat and crown rust in oats was quite constant from year to year and from station to station, and plumpness of grain, disease reaction, and date of heading were correlated significantly at the various stations. The yields at the central station were correlated more closely with those at Waseca than with yields of the same strains at Crookston or Morris, although the differences were not often significant statistically. The yields at Morris were correlated to a similar extent with those at Waseca and Crookston.

Twenty years of rotation and manuring experiments at Logan, Utah, G. Stewart and D. W. Pittman (*Utah Sta. Bul. 228 (1931), pp. 32, fig. 1*).—Experiments at the Greenville Experimental Farm for various periods since 1910 dealt with the yields of field crops grown manured and without manure, continuously, and in rotation on uniform deep rich loam, and the restoration of land depleted by the continuous growing of grain or sugar beets. Several series included alfalfa in combination with manuring.

By the use of manure and a good cropping system it appeared possible to maintain or build up high productivity in the soil. The manure was most effective on sugar beets and also was effective on alfalfa, potatoes, and corn, but was not so good on the small grains, where it usually caused lodging. Light applications of manure made often were much more effective than the same quantity used in fewer heavy treatments.

Rotation was usually beneficial to the small grains, being nearly as essential to them as was manure to sugar beets. Rotation was also important for potatoes, alfalfa, and corn, and was necessary for sugar beets on nematode-infested land. It was observed that sugar beets after small grains did not do as well the first year as when potatoes or peas came between the cereals and beets. When properly manured and with no nematode infestation, sugar beets continuous for two or three years were better than after other crops. Yields of alfalfa hay usually began to decrease when the stand was four or five years old, except on land that had been manured long and heavily. A rotation system including alfalfa and cultivated crops and with moderately heavy manuring maintained most successfully high yields of all crops studied.

San Juan County Experimental Farm progress report, 1925–30, inclusive, J. H. Eagar and A. F. Bracken (*Utah Sta. Bul. 230 (1931), pp. 15, figs. 3*).—Field crops experiments were carried on under dry farm conditions near Monticello in a region rather distant from railroads and with an average annual precipitation of about 17 in. and a 100-day frost-free period.

Alfalfa sown in drills, rows, and hills produced seed in only one of five seasons and then not enough for profit. Seedings in 28-in. rows or in hills produced more forage than in 7-in. drills, and Grimm outyielded other alfalfas tested. Australian White Flint corn, sweetclover, and field peas were of merit for forage. Mangels and stock carrots made fair yields when good stands were secured.

Other varietal leaders included Turkey (926), Blackhull, and Karmont winter wheat, Early Baart spring wheat, Swedish Select oats, Trebi barley, and Mexican Red beans. For winter wheat, from 2 to 4 pk. per acre sufficed for highest yields, and delayed spring plowing varied little in effect from early spring or fall plowing. Winter wheat yields differed so slightly after corn,

potatoes, peas, and fallow that wheat evidently could alternate with a row crop with probably little reduction in yield to either. The tillage practice found most economical in this connection consisted of fall plowing the stubble land, followed by early spring weeding and other necessary tillage before seeding the intertilled crop. After the row crop was harvested the only tillage needed for sowing the cereal was disking and harrowing.

[Rice and other field crops in Pacific regions] (*Proc. 4. Pacific Sci. Cong., Java, 1929, vol. 4, pp. 9–14, 33–131+II, 223–256, 271–275, 285–299, 355–370, 385–389, 401–408, 419–443, 471–482, 529–559, 603–606, 609–611, pls. 3, figs. 61*).—Papers presented at the Fourth Pacific Science Congress in Java in 1929 of special interest to agronomists included Past, Present, and Future in the Obtaining and Spreading of Superior Rice Varieties in the Dutch East Indies, by L. Koch (pp. 9–14); Present Position in Regard to Rice Production in Malaya, by H. W. Jack (pp. 33–44); The [World] Rice Situation, by M. B. Smits (pp. 45–131 + II); Complement on the Paper of M. B. Smits "The Rice Situation" (pp. 401–408); Irrigation and Drainage of the Rice Fields in the Netherlands Indies, by J. T. Metzelaar (pp. 223–229); Rice Import of the Netherlands Indies, by M. B. Smits (pp. 231–252); On the Improvement of the Techniques of Rice Cultivation in Japan, by H. Terao (pp. 253–256); The Rice Position in Ceylon, by F. A. Stockdale (pp. 271–275); Rice Production on Java and Madura, by A. M. P. A. Scheltema (pp. 285–299); The Azolla as a Green Manure [trans. title], by N. C. Tieu (pp. 355–370); Increasing the Yield of Rice on Java by Means of Manuring, by A. Wulff (pp. 385–389); Rice Growing on the Murrumbidgee Irrigation Areas, New South Wales, Australia, by C. K. H. Clair Potts (pp. 419–443); The Rôle of the Rarer Elements in Soils and Plants, by O. Schreiner (pp. 471–482); Some Phases of Rice Culture in Tonkin [trans. title], by P. Braemer (pp. 529–559); Experimental Studies on the Relation of Irrigation-Water Temperature to the Growth and Yield of Rice Plants, by S. Kikkawa and K. Tojo (pp. 603–606) (E. S. R., 62, p. 132); and Field Technic of the Determination of Comparative Yields in Wheat, by T. H. Shen (pp. 609–611) (E. S. R., 63, p. 442).

Crop plants under cultivation in Japan, M. Akemine (*Jour. Amer. Soc. Agron., 23 (1931), No. 3, pp. 161–174*).—The present contribution from the College of Agriculture of Hokkaido Imperial University lists the Japanese, English, and scientific names of 365 food, condimental, forage, medicinal, fiber, oil, paper, dye, and miscellaneous crops currently grown in Japan.

Chatham Station compares silage crops, B. R. Churchill (*Michigan Sta. Quart. Bul., 13 (1931), No. 4, pp. 212–215, fig. 1*).—Experiments at the Upper Peninsula Substation indicated that the Jerusalem artichoke could not compete with sunflowers as a silage crop nor with the purple top rutabaga as a root crop in the region.

The book of the lawn, R. Beale (*London and Toronto: Cassell & Co., 1931, pp. 151, pls. 8, figs. 25*).—A manual of information on the production and management of lawns and of turf for tennis, croquet courts, and cricket, Rugby football, and hockey fields.

A comparison of alfalfa strains and seed sources for Michigan, C. R. Megee (*Michigan Sta. Spec. Bul. 211 (1931), pp. 8, figs. 2*).—Hardigan alfalfa, found superior to other strains in winter hardiness, yielding ability, flower production, and uniformity of growth, and Grimm, second in yield and hardiness, are considered the most popular variegated alfalfas and most dependable for Michigan conditions. Northern and high altitude common strains, including LeBeau and those from Michigan, Montana, Kansas, Utah, and Idaho, and Dakota common, were among the better common alfalfas. Arizona common,

Hairy Peruvian, South African, and alfalfa seed from Argentina did not prove suitable for Michigan.

The effect of salt on the microbial heating of alfalfa hay, L. S. STUART and L. H. JAMES (*Jour. Agr. Research [U. S.], 42 (1931), No. 10, pp. 657–664*).—In a study of the heating of moistened hay in the flooded regions of Vermont in 1927 (E. S. R., 59, p. 326) many farmers reported marked success in preventing the molding and spontaneous heating of stored hay with a high moisture content by application of large quantities of salt. In laboratory studies to determine the reason for such effects of salt, moistened alfalfa hay, packed in a Dewar flask provided with an aerating tube left open, heated to 47.5° C. (117.5° F.), whereas no heating was observed when the aerating tubes were closed. Moistened alfalfa hay to which 1 per cent salt was added did not start to heat so soon as hay without salt and still later when 2 per cent of salt was added. With 30 per cent moisture and no salt, heat development was faster than with lower percentages of moisture, and the delay in heating when salt was added varied inversely with the quantity of moisture present. Differences were not apparent between the action of dry salt and salt in solution.

Examinations of unsalted hay at various stages of heating showed marked increases in mold and aerobic spore-forming bacteria as the heating progressed. Hay receiving 1 per cent salt showed marked increases in mold growth during the progress of heating. Hay with 2 per cent salt showed marked decreases in bacterial counts and increases in mold growth as heating went on. Hay containing 5 per cent salt and 30 per cent moisture molded and heated within 12 days.

Conclusions were that salt added to moistened alfalfa hay will inhibit bacterial growth and will delay but not prevent mold development. This delay in microbial development may be long enough to permit the curing of the hay.

The chemical composition of Ambrosia trifida at successive growth stages, R. B. DUSTMAN and L. C. SHRIVER (*Jour. Amer. Soc. Agron., 23 (1931), No. 3, pp. 190–194*).—The chemical composition of great ragweed (*A. trifida*) as determined at the West Virginia Experiment Station confirmed earlier reports as to its nitrogenous character and suggested the possibility of its utilization for forage or green manure. Other constituents reported on include ash, crude fiber, nitrogen-free extract, ether extract, and pentosans.

Barley production in South Dakota, K. H. KLAGES (*South Dakota Sta. Bul. 256 (1930), pp. 40, figs. 11*).—Variety and seeding tests with barley at the station and substations over extended periods are reported on, with information on the barley acreage in the State, the relative production and feed value of barley compared with other cereals, recommended cultural methods and field practices, and barley diseases. The characteristics and merits of varieties tested are described briefly. Barley probably could replace to advantage much of the oats now grown in the State.

The tests indicated about April 15 as the optimum seeding date, and acre rates of 6 pk. in eastern South Dakota, 5 in the central section, and 4 pk. in western South Dakota. Odessa led the varieties in eastern South Dakota; Manchuria and Oderbrucker equaled Odessa in yield in the central part of the State; Odessa and White Smyrna × Svanhals were good in north-central South Dakota; and Gatami, Ace, and White Smyrna did well in the far western section.

A gene influencing the composition of the culm in maize, M. T. JENKINS and F. GERHARDT (*Iowa Sta. Research Bul. 138 (1931), pp. 121–151, figs. 8*).—A gene influencing the strength of culm in corn, termed "lazy" (*La la*) and expressed in weak culms which result in a prostrate growth habit, was found in a cooperative study with the U. S. Department of Agriculture to behave as a

simple Mendelian recessive. The effect of the lazy character is not apparent until the culm begins to elongate rapidly. The culms of lazy and normal plants are similar in morphological structure but differ in the thickness of their cell walls.

The gene lazy greatly restricts the deposition of such structural materials as cellulose, lignin, and pentosans in the culm. Compared with normal stalks the lazy culms were found to contain more moisture per unit weight of green tissue; in earlier development less nitrogen, water-soluble material, and total ash constitutents on green weight basis; much less lignin and less cellulose in cell walls; smaller quantities of ash and total solids and lower osmotic pressure in the expressed juice; and lower ionizable constituents in the tissue fluids.

The prostrate habit of growth, characteristic of the lazy plants, according to the data, is due to a physical relationship between the strength of the supporting tissue and the weight of the plant to be supported. This relationship evidently results from a restricted deposition of the structural materials of the dry matter per unit weight of green material.

A study of the cotton plant, with especial reference to its nitrogen content, G. M. Armstrong and W. B. Albert (*Jour. Agr. Research* [*U. S.*], *42* (*1931*), *No. 10, pp. 689–708, figs. 3*).—When Cleveland cotton was grown at the South Carolina Experiment Station in field plats in 1925, 1926, and 1927 with a relatively low and a relatively high supply of nitrogen, the concentration of nitrogen in the leaves, stalks, and fruits generally was greatest on the high nitrogen plats and was correlated with a greater succulence of the tissues. A greater percentage of dry matter was present in the tissues of plants from low nitrogen plats. Developing seed and lint from 7 to 21 days of age showed about the same nitrogen concentration under both nitrogen conditions. Boll walls and lint at later stages in 1926 showed lower concentrations of nitrogen with the low nitrogen supply. The relative proportions of the total nitrogen present in the stalks were lower on low nitrogen plats than on high nitrogen plats. The nitrogen percentage in all tissues, with the possible exception of seed, tended to decrease with maturity.

Closely spaced plants in 1925 and 1926 had a larger proportion of stalks to total dry weight and a larger proportion of their nitrogen in bolls than did widely spaced plants, and they absorbed a larger proportion of the total nitrogen relatively early and in 1926 took up considerably more nitrogen.

Just before the rapid production of flower buds about three-fourths of the dry weight of the plant and from 80 to 90 per cent of the nitrogen were present in the leaves. The proportion of leaf weight to plant weight declined steadily and that of boll weight to plant weight increased until the end of the fruit setting season, when only one-fifth to one-third of the dry weight of the plant and from 30 to 55 per cent of the nitrogen was present in the leaves, and from 40 to 60 per cent of the nitrogen was found in the bolls. At 21 days of age when bolls were of full size but not mature, about one-half of the boll nitrogen was present in the wall tissue.

The stalks showed early in the season an increase in proportion of total weight and later a gradual decline, with a decrease in the proportion of nitrogen. The proportion of root weight to total weight was relatively small, ranging from 9.9 to 5.8 per cent during the 1926 period of root collections. The proportion of the total nitrogen ranged from 4.1 to 1 per cent.

The total nitrogen absorbed by the plants early in the season was not large, although the absorption rate was very rapid due to the increase in size of the small plants. Under certain seasonal conditions, as in 1926, older plants absorbed from 40 to 50 per cent of the nitrogen of the crop in about 2 weeks.

Influence of potash sources and chlorine content of fertilizers on yield of cotton, J. J. SKINNER (*Jour. Amer. Soc. Agron.*, *23* (*1931*), *No. 1*, *pp. 13–21*).—That potassium chloride as a source of potash in mixed fertilizers for cotton in the Coastal Plain and Piedmont regions of the Southeastern States is as good a form of potassium as potassium sulfate was shown by experiments on many soil types. Kainite did not show up as favorably as potassium chloride and potassium sulfate. The effect of chlorine applied in potassium chloride did not appear likely to become an unfavorable factor. As much as 112 lbs. of chlorine per acre was supplied without unfavorable results, and larger applications on some soils did not retard growth or reduce yield. However, 900 lbs. per acre of a 4 per cent potash fertilizer made from kainite supplied 118 lbs. of chlorine, which seemed near the limit of chlorine endurance of cotton in most soils. In compounding fertilizers it would not seem good practice to have the entire source of potash and nitrogen in a fertilizer mixture derived from potassium chloride and ammonium chloride, since indications were that the amount of chlorine supplied by the two salts when used in a mixed fertilizer at the rate of 900 lbs. per acre is excessive for the best growth and yield of cotton.

Changes in the sugar, oil, and gossypol content of the developing cotton boll, C. CASKEY, JR. and W. D. GALLUP (*Jour. Agr. Research* [*U. S.*], *42* (*1931*), *No. 10*, *pp. 671–673*).—Continued studies at the Oklahoma Experiment Station on the gossypol in cotton seed (E. S. R., 59, p. 434) revealed that gossypol and oil increased rapidly in the seed from the twenty-first until the thirtieth day of the development of the boll. The gossypol increased more rapidly than the oil, and continued to increase slowly until the boll was 50 days old and fully matured. The sugars in all parts of the boll decreased gradually during the period of growth.

The accuracy of cotton lint percentage figures, J. R. QUINBY and J. C. STEPHENS (*Jour. Amer. Soc. Agron.*, *22* (*1930*), *No. 2*, *pp. 157–163*).—Ginning tests were made at the Chillicothe, Tex., Substation on 10-lb. samples from early, medium, and late pickings of 24 cotton varieties compared in 1928, and on 50 samples of 10 lbs. and 30 lbs., and on 50 200-gm. samples from a mixed bulk of Mebane cotton.

The results indicated that when cotton is ginned in an experimental gin a representative sample of the entire plat production of seed cotton or a composite sample of quantities in exact proportion to the yields of each picking is needed for accurate figures for lint percentage and consequently for acre yield. An 8-saw gin and a 20-saw gin ginned random samples from the mixed bulk of Mebane cotton with consistent accuracy, and the effect of errors in ginning upon the acre yield of lint cotton computed from plat yields was unimportant. One sample sufficed to give reliable acre yields of lint cotton when the samples were ginned on either gin, although the larger gin gave the more accurate result. With 10-lb. samples ginned on the 20-saw gin the probable error of a single determination was about 0.2 per cent of lint, or 2 lbs. of lint per acre, based on the yield of 1,000 lbs. of seed cotton.

In view of the differences in lint percentage between varieties shown in the 1927 tests and the possible influence of fertilizer, soil, and seasonal conditions on lint percentage, there seemed little justification for interpreting results on the basis of seed cotton yields. Computation of lint percentage as the ratio of lint to clean seed cotton seemed more desirable than as the ratio of lint to raw cotton, since it avoids the effect of actual differences in the quantity of dirt and waste in the seed cotton as harvested.

Percentage of lint in distributed plats of cotton varieties, J. R. QUINBY and J. C. STEPHENS (*Jour. Amer. Soc. Agron.*, *23* (*1931*), *No. 1*, *pp. 67–69*).—In

the 1929 cotton variety test at the Chillicothe, Tex., Substation a 10-lb. sample was ginned from each of four distributed plats of 24 varieties. Assuming 33.3 per cent of lint as a general mean for all varieties, the probable error was 0.279 per cent of lint, slightly higher than the error of 0.2 per cent of lint found above.

Successive pickings of a variety were much more variable in percentage of lint than were total pickings from distributed plats of the same variety. Although the yields of the distributed plats of a variety varied considerably, lint percentage was relatively constant from plat to plat. In an experiment on comparatively uniform land, a lint percentage figure properly derived from ginning the production of a single plat may be applied without substantial increase in error to the replicated plats; or, when the seed cotton production of a single plat is below 10 lbs., the seed cotton produced on two or more of the distributed plats may be massed and a representative sample drawn.

The effects of manure and mineral fertilizers on the yield and nicotine content of Nicotiana rustica [trans. title], M. Górski and J. Krotowiczówna (*Rocz. Nauk Rolnicz. i Leśnych* (*Polish Agr. and Forest. Ann.*), *24* (*1930*), *No. 1, pp. 1–16; Ger. abs., pp. 15, 16*).—Manure at different rates, alone and with various combinations of mineral fertilizers, was applied to *N. rustica* from 1927 to 1929. *N. rustica* evidently had a very large fertilizer requirement, especially for nitrogen, necessitating the application of well decomposed manure before winter. For good yields heavy applications of nitrogen should be used. With average manure applications the need for potassium and phosphorus was much smaller. Nitrogen applications had a large influence on the content of nicotine. In all three years the nicotine content where complete fertilizer was applied was much larger than on plats without nitrogen. Omission of potassium resulted in a lowering of nicotine content but not to such an extent as with no nitrogen. Lack of phosphorus was followed by a slight increase in nicotine.

Fertilizer experiments with Nicotiana rustica [trans. title], M. Górski and S. Klarner (*Rocz. Nauk Rolnicz. i Leśnych* (*Polish Agr. and Forest. Ann.*), *24* (*1930*), *No. 1, pp. 17–28, fig. 1; Ger. abs., pp. 27, 28*).—*N. rustica* responded most to nitrogen and secondarily to potassium. Analysis of the leaves showed the omission of nitrogen and potassium to result in lowered nicotine content, whereas lack of phosphorus caused an increase.

The effect of nitrogen on the yield and nicotine content of Nicotiana rustica [trans. title], M. Górski and S. Klarner (*Rocz. Nauk Rolnicz. i Leśnych* (*Polish Agr. and Forest. Ann.*), *24* (*1930*), *No. 2, pp. 201–208, fig. 1; Ger. abs., p. 208*).—The yields were quite proportional to the rate of application of sodium nitrate. The response to ammonium sulfate was much smaller than to sodium nitrate, especially with the larger quantities of nitrogen, probably due to its physiological acidity. The nicotine content of *N. rustica* rose with increasing applications of both salts.

Fertilizer experiments with Nicotiana tabacum and N. rustica [trans. title], M. Górski and J. Krotowiczówna (*Rocz. Nauk Rolnicz. i Leśnych* (*Polish Agr. and Forest. Ann.*), *19* (*1928*), *No. 2, pp. 249–264; Ger. abs., pp. 263, 264*).—*N. tabacum* responded above all to potassium and next to nitrogen. *N. rustica* responded first to nitrogen, and the omission of potassium did not affect the yield. The content of nitrogen was about alike with either fertilization. The lack of phosphorus and potassium resulted in much smaller contents of these elements, especially as to the potassium content in *N. rustica*. In the plants without potassium there was 0.5 per cent of potash in the leaves, whereas with complete fertilizer there was about 3 per cent. Similar quantities of potassium, phosphorus, and nitrogen were taken up by both plants from complete fertilizers, and in kilograms per hectare were nitrogen about 45, phosphoric acid

about 25, and potash about 100. *N. rustica* had a much greater ability to utilize the soil potassium than did *N. tabacum*. The nitrogen content appeared to depend very slightly upon the fertilizer.

The peanut crop in Arkansas, C. K. McClelland (*Arkansas Sta. Bul. 263 (1931), pp. 15*).—Experiments with peanuts during ten seasons within the period 1918–1930 showed that acre yields of from 800 to 1,300 lbs. of nuts and 1.5 to 2 tons of hay might reasonably be expected with any variety. Spanish and slender pod types are recommended for northwestern Arkansas; the large pod types yielded well but bore nuts of poor quality. Better results were had with large pod types in southwestern Arkansas on sandy soils and with longer seasons.

For the Spanish, slender pod, and large pod types the respective average percentages of nuts in the hay ranged from 32.4 to 35.2, 23.5 to 26.6, and 21.8 to 29.6; weights per bushel, 20 to 26, 15.5 to 18.5, and 12 to 17.5 lbs.; and shelling percentages 66.5 to 73, 58.7 to 66.8, and 53.7 to 60 per cent.

Tests with Spanish and Valencia favored close spacing in narrow rows, 30-in. rows with hills from 4 to 6 in. apart seeming most desirable. The fact that the Spanish averaged 43.6 per cent higher than Valencia in the production of nuts and 15.1 per cent higher in hay yields favored the Spanish for northwestern Arkansas conditions.

Northern and native-grown potato seed stock, K. C. Westover (*West Virginia Sta. Bul. 242 (1931), pp. 20*).—Native strains of Smooth Rural potatoes maintained at high-altitude and low-altitude limits for seed production and a strain produced at Fosston in northern Minnesota were compared as to yield during the period 1921 to 1924, inclusive, at four altitudes of from 1,000 to 2,000 ft. in West Virginia and at the Kentucky and Minnesota Experiment Stations.

The native strains, especially the high-altitude, surpassed the northern-grown strain in initial increase plantings at the station in 1921, and these yield differences apparently persisted. The high-altitude and northern-grown strains usually gave greater yields at the higher altitudes and the low-altitude strain at the lower altitudes. The native strains compared favorably with and did not deteriorate faster than the northern strain, indicating that seed potato production in the medium altitudes of West Virginia is feasible.

A tendency was apparent for the northern-grown and the high-altitude seed strains to outyield the low-altitude strain in trials in Minnesota and in the higher altitudes of West Virginia, whereas the low-altitude strain usually was superior in Kentucky and in the lower altitudes of West Virginia.

Hill spacing tests with potatoes, H. C. Moore, E. J. Wheeler, and J. J. Bird (*Michigan Sta. Quart. Bul., 13 (1931), No. 4, pp. 203–205*).—That closer spacing of potatoes in the row tends to reduce losses from hollow heart, oversize, and rough potatoes and increases the acre yield of marketable tubers was shown by trials over 5 years on both fertilized and unfertilized soils and with summer rainfall above and below normal. Spacing the hills from 12 to 18 in. apart in the row is recommended, and planting in check rows 36 by 36 in. is discouraged.

A taxonomic study of Poa bulbosa L., M. Halperin (*Calif. Univ. Pubs. Bot., 16 (1931), No. 6, pp. 171–183*).—A comprehensive taxonomic description of *P. bulbosa* is presented, together with a review and criticism of the literature on this grass.

Early trials and use of reed canary grass as a forage plant, F. J. Alway (*Jour. Amer. Soc. Agron., 23 (1931), No. 1, pp. 64–66*).—A contribution from the Minnesota Experiment Station on the history of this grass (E. S. R., 64, p. 30).

The Porto Rico sugar manual, including data on Santo Domingo mills, A. B. Gilmore (*New Orleans: A. B. Gilmore, 1930, pp. XII+280, figs. 20*).—

Dedicated to the memory of F. S. Earle, this book presents information on the ownership, equipment, operation, sugar production, and agricultural conditions for various centrals in operation in Porto Rico and the Dominican Republic in 1930. The manual also includes papers on different phases of the cane sugar industry presented at the 1929–30 meeting of the Association of Sugar Technologists of Porto Rico.

Sudan grass is valuable pasture crop in Michigan, A. B. Dorrance (*Michigan Sta. Quart. Bul., 13 (1931), No. 4, pp. 183–187, fig. 1*).—During comparisons of emergency pasture crops under drought conditions on Bellfontaine sandy loam near Augusta, Sudan grass in 1929 furnished sheep more than twice as much pasturage as rape. In 1930 Sudan grass afforded 343 sheep days pasturage, sweetclover (first year) 286, rape broadcast 249, alfalfa (first year) 241, and rape in 21-in. rows 162 days. The carrying capacity of Sudan grass used for dairy cows approximated that of the plats grazed with sheep, i. e., nearly one cow per acre for July, August, and part of September. Cultural suggestions have been given earlier (E. S. R., 55, p. 132).

Correlation of factors affecting yield in hard red spring wheat, R. O. Bridgford and H. K. Hayes (*Jour. Amer. Soc. Agron., 23 (1931), No. 2, pp. 106–117*).—Within 11 characters studied in 61 hard red spring wheat strains grown in the 1929 rod-row trials at the Morris, Minn., Substation, yield was correlated positively with plumpness of grain, weight of 1,000 kernels, date of heading, and height and negatively with leaf rust. Plumpness of grain was correlated positively with weight of 1,000 kernels, date of heading, and number of heads per row and negatively with stem rust and kernels per spike. Date of heading showed positive correlations with heads per row and negative correlations with height and leaf rust. Height was correlated positively with kernels per spike and kernels per spikelet and negatively with leaf rust. Conclusions were that number of kernels per head and spikelet and growth vigor as expressed by heads per row and by plumpness of grain combined with resistance to disease should give an ideal variety of spring wheat. Such a combination should be obtained from the characters found in the N. D. 1656 selections, the Minnesota double crosses, and the [E. S.] McFadden selections from crosses of Marquis with emmer.

The immediate effect of foreign pollen upon the kernel weight of wheat (Triticum vulgare), C. E. Rosenquist (*Jour. Amer. Soc. Agron., 23 (1931), No. 1, pp. 43–63, figs. 2*).—Hybrid vigor in kernel weight among wheat crosses was studied at the Illinois Experiment Station in 107 crosses among 28 lines and varieties of common wheat. The crosses included 7,527 selfed and 5,730 crossed kernels.

When produced on the same spikes as selfed kernels, crossed kernels averaged 8 per cent smaller and when produced on different spikes 10 per cent smaller than selfed kernels. The selfed kernels averaged about 5 per cent larger than incrossed (crossed with pollen from plants of the same pure line seed of the female parent) kernels, suggesting a slight error due to the crossing method. Only 17 per cent of the crosses showed some degree of increase; all others exhibited decreases of crossed as compared with selfed kernels. A general decrease in weight of crossed as compared with selfed kernels was evident. In general there was no significant increase in kernel size which could be attributed to the phenomenon of xenia.

State laws concerning the sale of seeds and legume inoculants, J. G. Fiske (*New Jersey Stas. Circ. 248 (1931), pp. 15, fig. 1*).—Superseding Circular 218 (E. S. R., 62, p. 523), this gives the text of the act of 1931 regulating the sale of seed in New Jersey and of the act of 1919 regulating the sale of legume inoculants, and explains the requirements of the two acts.

When to treat quackgrass most effectively with chlorates, H. K. Rowley (*Jour. Amer. Soc. Agron., 23 (1931), No. 1, pp. 41, 42*).—A single application of 10 per cent solution of sodium chlorate at the rate of 250 gal. per acre at the West Virginia Experiment Station failed to free an infested field from quack grass. Two applications, whether made in June and October or in December and April, practically eradicated the weed, the latter treatment appearing somewhat more effective. Evidently quack grass need not be actively growing to be killed by chlorates; applications on dried tops were even slightly more effective than on green leaves and stems. Sodium chlorate solution at the rate used was not highly toxic to Kentucky bluegrass, particularly in the December and April applications.

HORTICULTURE

The effect of various containers on the growth of vegetable plants, E. S. Haber (*Iowa Sta. Bul. 279 (1931), pp. 149–164, figs. 12*).—The superiority of clay containers could be grown. Species differed in their response, cabbage, young vegetable plants was established, but it was found that if the plants in these substitute containers were watered with a solution of nitrate of soda, ammonium sulfate, or other nitrogenous fertilizer, plants equal to those in the clay containers could be grown. Species differed in their response, cabbage, for example, growing in peat pots quite as well if not better than in clay pots. Too frequent use of nitrogen resulted in soft, succulent plants. For species sensitive to acidity presoaking of the peat containers in lime water proved desirable. Pulp pots were nearly neutral and needed no liming. Plunging composition pots in soil increased their value as plant growers but added to the difficulty of handling because of softening. Plants grown in peat pots, pulp pots, and pulp planting pots did not generally outyield clay pot plants but were superior to flat-grown plants.

Cultivation experiments with certain vegetable crops on Long Island, H. C. Thompson, P. H. Wessels, and H. S. Mills (*New York Cornell Sta. Bul. 521 (1931), pp. 14, fig. 1*).—Supplementing earlier work conducted at Ithaca (E. S. R., 58, p. 137), the results are herein presented of studies conducted at the Long Island Vegetable Research Farm from 1923 to 1930 with beets, cabbage, carrots, onions, potatoes, and tomatoes.

As at Ithaca, the yield data showed conclusively that the principal benefit from tillage is the control of weeds. The maintenance of a soil mulch by cultivation did not increase significantly the yield of any of the crops, although the odds were 27 : 1 in the case of cabbage. With the potato the scraped plats produced a slightly higher yield, odds 100 : 1, each year than did the tilled plats. Weed growth was disastrous to all crops, reducing the yield of carrots about 80 per cent, beets 50, onions 95, tomatoes 80, and potatoes 67 per cent.

Late cultivation was not beneficial, the evidence being that after a crop is about half grown tillage is unnecessary unless weeds are abundant, and may be distinctly harmful by injuring roots and increasing water loss. Culture soon after a light rain is inadvisable, merely hastening water loss. Deep cultivation is deemed rarely if ever essential, since if from 3 to 4 in. of soil is kept stirred roots are destroyed, preventing the plant from absorbing water from the stirred zone.

Factors affecting the quality of commercial canning peas, C. B. Sayre, J. J. Willaman, and Z. I. Kertesz (*New York State Sta. Tech. Bul. 176 (1931), pp. 76, figs. 8*).—In a study of the chemical changes associated with differences in quality, principally tenderness, of canning peas the results of analyses showed wide differences in mineral content and ratio of minerals, with only slight variations in organic constituents resulting from differences in fertilizer treat-

ment, in time of harvest, variety, and enzyme action following shelling. Large differences were recorded in the inorganic content of the leaves and stems as a result of the factors cited, but the variations in seeds, especially seed coat, were very slight. Apparently differences in the proportion of calcium and potassium in the nutrient solution may cause an organic base exchange in which calcium and potassium may partially replace one another. Potassium and calcium content was influenced slightly by the potassium and calcium compounds applied to the soil.

Three harmful changes occurred in peas following an extended delay between shelling and canning, namely, enzymic changes in carbohydrate and nitrogen constituents, increased toughness, and increased calcium content of the seed coat. Incidentally the tougher peas had the higher calcium content. Changes in pea ovules as they matured included increases in dry matter, starch, and the protein-nonprotein ratio, and the translocation of calcium to the seed coat. These changes made the peas tougher and were found measurable by mechanical means, such as crushing, and such a procedure is proposed for determining when peas should be harvested. Potassium fertilizers tended to reduce toughness, while calcium chloride tended to increase this condition. Potassium chloride was not found harmful.

Some effects of chilling temperatures on sweetpotatoes, J. I. LAURITZEN (*Jour. Agr. Research [U. S.], 42 (1931), No. 10, pp. 617–627, pl. 1*).—Sweetpotatoes exposed in controlled chambers for a period of more than 20 days to temperatures ranging from 0 to 5° C. and relative humidities of from 62 to 96 per cent gradually became infected by such fungi as *Mucor racemosus*, *Botrytis cinerea*, *Penicillium* sp., and *Alternaria* sp. At the same time, with the exception of one root which at 9.5° showed slight internal browning, there was no evidence of injury in roots held at from 9.5 to 10°.

Germination tests of roots chilled for 40 days at 4.5° showed a decline in two tests, with none in a third in which the roots were exposed for 45 days. In the case of roots chilled at 0.1°, there was a decline in percentage germination, starting at the chilling period of 15 days and reaching 0° with 29 days' exposure. Prolonged exposure at low temperature thus subjected the roots to infection and loss of viability and led to the practical conclusion that it is inadvisable to expose sweetpotatoes to temperatures lower than 10° (50° F.).

Regarding change of temperature in storage, the percentage of infection was smaller where the low temperature was maintained than where it was raised to from 10 to 25°. At the higher temperatures certain forms of Fusarium apparently invaded the roots through the lesions caused by the other fungi. At 4.5° the percentage of infection was directly proportional to the relative humidity. At 0.1° infection was less at a relative humidity of 79 per cent than at 64 per cent.

Pollination experiments in fruit trees at Alnarp 1926–1930 [trans. title], E. JOHANSSON (*Sveriges Pomol. För. Årsskr., 32 (1931), No. 1, pp. 1–34, fig. 1; also Meddel. Perm. Kom. Fruktodlingsförsök [Sweden], No. 23 (1931), pp. 37, fig. 1, Eng. abs., pp. 33–36*).—Of two varieties of apricots, Ambrosia and Apricot of Tours, both were found self-fruitful. All sweet cherries and one Duke variety, Minister Podbielski, were self-incompatible, with evidence of cross incompatibility between certain varieties. Rivers Early was a good polliniser for a number of other cherries. Several plums, including Golden Esperen, Belvoir, and Virginale blanche, were found practically pollen sterile. No evidence of cross incompatibility was seen in plums. Victoria proved to be a useful polliniser for a large number of other varieties. Pears were generally unfruitful when self-pollinated, with considerable tendency toward parthenocarpy in certain varieties. Belle Lucrative was found a satisfactory polliniser

No case of cross incompatibility was observed in the pear. Practically all of the apples studied were not satisfactorily self-fruitful. Cox Pomona and Ribston Pippin were found cross incompatible, and poor results were obtained in reciprocal crosses between Allington Pippin and Cox Orange. The Danish apple Filippa proved a good pollinizer for other kinds. Self-pollination of pears and apples resulted in few viable seeds, and the resulting seedlings were weak.

Experiments in raising rootstocks from seeds of commercial apple sorts [trans. title], C. G. Dahl (*Sveriges Pomol. För. Årsskr., 31 (1930), No. 3, pp. 129–135, figs. 3; also Meddel. Perm. Kom. Fruktodlingsförsök [Sweden], No. 20 (1930), pp. 8, figs. 3, Eng. abs., pp. 7, 8*).—Studies at Alnarp, Sweden, upon the value as stocks of open-pollinated seedlings of several commercial apples showed decided differences which could not be associated with the vigor of the parent. A study of the growth of ungrafted seedlings and of seedlings with Cox Pomona as scion showed the best growth on seedlings of the King of Pippins, Reinette Ananas, Akero, Bismarck, and certain Swedish varieties. Reinette Baumann, Ribston, Belle de Boskoop, Blenheim, Gravenstein, and some Swedish varieties proved unadaptable for growing stocks. Apparently varieties with a supernormal number of chromosomes are to be avoided. Grading experiments with the seedlings indicated the desirability of discarding small and weak plants before propagation.

Root regeneration upon transplanted apple rootstocks, T. Swarbrick (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt. 1929, pp. 40–46, pls. 3*).—Current year layers of Malling Type 13 apple stocks, part with all roots removed and part not root pruned in any way, were transplanted on October 15 while in full leaf and still making shoot growth. One month later new roots were observed on all stocks irrespective of pruning treatment. At the end of three months (January 18) the root-pruned lots were clearly making the more vigorous root regeneration. As regards the effect of size of the original stock, the differences in regeneration were purely quantitative. At the end of five months (March 20) the same relative differences as noted in January persisted. On the unpruned stocks there were found, in addition to thick, fleshy, unbranched roots arising from the main stem, many small sharply pointed new roots arising as laterals from the old root system, although at this time no exfoliation of buds was evident. At the end of May the unpruned stocks appeared superior in respect to the amount and feeding capacity of their root systems because of the existence of two types of roots, the new primary and the short laterals from the old system. Whether this advantage was to become a permanent benefit was questioned but rather expected.

The identification of apple varieties from non-bearing trees, J. K. Shaw and A. P. French (*Massachusetts Sta. Bul. 274 (1931), pp. 57–87, figs. 29*).—Accompanied by a series of photographs of the leaves of various apples, detailed information is presented on the characteristics of tree, bark, shoots, and leaves which have served to enable the authors to identify trees accurately prior to their fruiting.

The time of differentiation of the flower-bud of the apple, M. A. Gibbs and T. Swarbrick (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt. 1929, pp. 34–39, pl. 1*).—Using as material buds of the Lane Prince Albert apple grown on Malling Type 2 rootstocks, the authors found in 1928 studies that differentiation of flower buds on spurs one and two years old begins during the last two weeks of June. Sepal primordia were distinguishable in the buds on July 2. On current year's wood not all of the axillary buds developed into flower buds. Where blossoms were initiated the primordia were found present in their first stages in buds gathered August 4. Axillary buds developed much

more rapidly than spur buds, so that by the close of the growing season there was little difference in the growth status of the two groups.

The shape and quality of apples in relation to their position in the fruit cluster, J. C. Hinton and T. Swarbrick (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt. 1929, pp. 67–72, pl. 1*).—Observing the fact that various grades of apples are produced on a single tree, this study was begun at the Long Ashton station, working with labeled fruits of Allington Pippin, to determine in what position on the tree or in the cluster the good and poor fruits are located. As early as July it was noticed that the terminal fruits in a cluster tended to elongate more rapidly than did lateral borne fruits, a situation which was accentuated as the season progressed. In the mature apple the stalk of the terminal fruit was invariably shorter and thicker than that of the lateral apples. Observations on stored fruits indicated that the terminal ones kept better, having on December 20 a more attractive appearance and firmer flesh. The lateral fruits were, however, much sweeter, more aromatic, and apparently less acid.

Self-fertility and self-sterility in cider varieties of apples, G. T. Spinks (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt. 1929, pp. 28–33*).—Records taken on the set of fruit obtained from selfed and open-pollinated flowers showed two varieties, Dabinett and Reinette Obry, to be self-fruitful, 7 varieties slightly self-fruitful, and 4 semi-unfruitful. Open pollination was almost invariably more successful than selfing.

Pot experiments on the manuring of fruit trees.—V, The effects of deficiencies of potassium, calcium, and magnesium, respectively, on the contents of these elements, and of phosphorus in the shoot and trunk regions of apple trees, T. Wallace (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt. 1929, pp. 47–58*).—An abridged form of a previously noted paper (E. S. R., 62, p. 839).

Permeability of the skin of apples as measured by evaporation loss, K. S. Markley and C. E. Sando (*Plant Physiol., 6 (1931), No. 3, pp. 541–547*).—Utilizing a total of 16 varieties of apples, 11 of which were duplicated by obtaining them from different localities, namely, western New York and the Wenatchee Valley, Wash., the authors determined the evaporation loss per unit area from normal fruits and from those in which the stem and calyx ends were blocked with paraffin. In 1929 New York apples with two exceptions, Grimes and Wagener, had a higher water loss than did Wenatchee fruit, a difference believed due to the greater permeability of the New York apples. The stem and calyx losses varied according to variety from 0 to 31 per cent, and the variation in normal specimens was also large. Among rapid losers of water were Esopus, Winesap, Stayman, Arkansas, and Grimes (Wenatchee).

Removal of spray residue from Ohio grown apples, C. S. Holland (*Ohio Sta. Bimo. Bul. 151 (1931), pp. 123–129*).—Analyses for arsenic residue of 73 samples of apples collected in 1930 in various parts of the State showed 30 lots with 0.01 or more grains of arsenic trioxide per pound of fruit. It is emphasized that these data were obtained in an exceedingly dry year with little or no rainfall to cleanse the fruit. Work with apples from experimental spray plats showed clearly that 3 lbs. of lime to 50 gal. of spray reduced arsenical residue, that four sprays of arsenate of lead brought the residue up to 0.01 grain, that stickers increased the residue, and that oil had little influence on the amount of residue. In observations on other lots 5 lbs. of lime reduced the residue, and dusted fruit carried less arsenic than that from sprayed trees. The details of tests with wiping and washing machines are given and show results decidedly in favor of the latter.

Seasonal changes in total, soluble, soluble-protein, non-protein, and insoluble nitrogen in current year's shoots of Bartlett pear, A. S. Mulay (*Plant Physiol., 6 (1931), No. 3, pp. 519–529, figs. 2*).—The results of analyses at the University of California of samples of current season growth, collected at monthly intervals from September, 1927, to January, 1929, showed that new growth starts with high total nitrogen in the bark followed by a decline as growth proceeds. With the cessation of active growth total nitrogen increased, reaching a maximum in winter. Insoluble nitrogen was mainly influenced by these seasonal changes. Total nitrogen in the wood changed somewhat similarly to that in the bark, but in the wood changes in soluble nitrogen were mainly responsible for the seasonal fluctuations. Soluble proteins, forming only a small fraction of the total nitrogen in the bark and in the wood, increased in late summer and autumn and declined in late winter and spring.

Residual effects of fruit thinning with the Lombard plum, J. H. Waring (*Michigan Sta. Tech. Bul. 112 (1931), pp. 36, figs. 13*).—Seeking to determine the effect of thinning fruits on the subsequent growth and fruiting performance of the tree, studies were made with Lady apples and Lombard plums, particularly the latter. Thinning in 1925 and 1926 of Lombard trees planted in 1920 and bearing for the first time in 1924 reduced the total crops both years, though the size and weight of individual fruits were increased in proportion to the thinning. Crop failure occurred in 1927, and without further thinning the treated trees outyielded the nonthinned in 1928 but produced less fruit in 1929. In 1927 without exception the numbers of fruit buds in thinned trees were greater on the wood of three years' formation, accompanied in general by a corresponding decrease in numbers of leaf buds. In 1928 the percentage set, especially the terminal shoot set, was greater on trees that were thinned in 1926.

Thinning a heavy set of fruit resulted in the current year in increased trunk circumference, shoot length, shoot diameter, and summer wood in the xylem, but delayed the formation of terminal buds. Thinning effects were carried over to the second year, when, despite no crop, length, thickness, and dry weight of shoots were greater on the previously thinned trees. It was evident that thinning prolonged the vigor and functioning of the spurs. The growth stimulus to lateral shoots and spurs from fruit thinning was localized in those toward the distal end of a season's growth. Spurs of thinned trees carried more leaves and apparently developed more secondary spurs the succeeding year. Leaves, particularly shoot leaves, developing the year following thinning were larger and thicker on thinned trees. Accompanying increased shoot length, the internodes were found to increase in length as well as number; hence, the number of leaves was not strictly proportional to length of shoots.

Chemically the percentage differences in constituents were not sufficiently consistent to warrant correlating with thinning treatments. The author believes that the relative quantities of stored carbohydrates, nitrogen, and other constituents might be more significant. Apparently the less fruit there is on an apple or plum tree the lower is the percentage of water in spurs, shoots, and branches and the more easily the water is lost in drying.

In general conclusion the author suggests the advisability of regular thinning, since overbearing followed occasional thinning.

The value of plant and tip selection in the propagation of the black raspberry, S. Johnston (*Michigan Sta. Quart. Bul., 13 (1931), No. 4, pp. 195–199*).—Observations on the growth and yield of Cumberland black raspberry plants grown from rooted tips of known weight and parentage showed that the length of shoots the first season following planting was greater as the weight of the tips increased, but that neither the number of shoots per crown nor

the average diameter of shoots was materially influenced in the later life of the plant. There was little, if any, correlation between the size of tips and the number of shoots or of canes per hill. Weight was relatively unimportant in determining yield, except in the case of extremely small tips, which the author concedes would ordinarily be discarded in planting. Pruning at the beginning of the second year apparently reduced the plants to a similar level and probably removed the benefit of the increased growth observed during the first year. Yields for the first year were about as good as those of the next two years, due to favorable growing conditions that prevailed. Practically no correlation was observed between the productivity and growth of the parent plants and the performance of the progeny, suggesting that in black raspberry propagation the object is to secure healthy tips, irrespective of parentage. As regards pruning, production increased in direct proportion to the number of strong canes per hill.

Respiration studies of strawberries, E. L. Overholser, M. B. Hardy, and H. D. Locklin (*Plant Physiol., 6 (1931), No. 3, pp. 549–557*).—In this contribution from the Washington Experiment Station the authors report that strawberry varieties with firm flesh are not necessarily of low respiration intensity, either when immature or ripe. With the varieties under observation the firm-fleshed kinds had the higher respiration ratio. Respiration intensity increased with advancing maturity. No apparent depression of the respiration intensity followed the increased carbon dioxide concentration attained in the respiration chambers as a result of lengthening the respiration period. Consistent differences noted between varieties in their respiration intensities were not found directly correlated with keeping quality, because this was also influenced by initial firmness of the fruit. Greater maturity of fruit was correlated with a higher respiration ratio, although unity was never reached. Specific gravity was somewhat higher in mature than in immature berries of the same variety.

Families of strawberry seedlings bred for resistance to aphis, G. T. Spinks (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt. 1929, pp. 17–27*).—Data are presented on the results of crossing certain aphis-resistant varieties of strawberry with the high quality varieties Royal Sovereign and Stirling Castle. The aphis-resistant variety Tardive de Leopold apparently transmitted its resistance to aphis to a strong degree, but the progeny of this variety crossed by Sovereign was highly susceptible to mildew, evidently contributed by the Royal Sovereign parent. Tardive de Leopold×Stirling Castle gave rise to a progeny possessing resistance to both aphis and mildew and yielded some promising individuals for propagation. In both crosses mentioned about half the plants bore pistillate flowers. Several other crosses were made but were less promising.

Modern grape growing, F. Carpentieri (*Trattato di Viticoltura Moderna. Casale Monferrato, Italy: Ottavi Bros., 1929–1930, vols. 1, pp. XXIII+814, figs. 290; 2, pp. XX+704, figs. 318*).—A general treatise on the culture of the vinifera grape, discussing propagation, pruning, fertilization, and various other phases of grape growing.

An experiment on brushing-out Washington Navel orange trees, A. D. Shamel and C. S. Pomeroy (*Calif. Citrogr., 16 (1931), No. 8, p. 362, fig. 1*).—Brushing out, that is, the removal of dead or decadent growth and suckers, from 26-year-old healthy bearing Washington Navel orange trees failed to exert any appreciable influence on total yield or on the grade of fruit in the two succeeding crops. No advantage was seen in respect to the growth of the tree.

Organic matter and pineapple production, N. King (*Pineapple Quart. [Hawaii. Pineapple Canners' Sta.], 1 (1931), No. 1, pp. 45–49, fig. 1*).—To deter-

mine the effect of pineapple residues when used as green manure, records were taken on a series of plats established at the Wahiawa Experiment Station, the soil of which showed marked deficiencies in potassium oxide and phosphoric acid. The conclusions were reached that pineapples respond to an increased organic matter content in the soil and that no toxic effect results from the use of pineapple residues as a source of organic matter.

Characteristics of the canned fruits of hybrid pineapples—results of the seedling cutting bee for 1930, J. L. COLLINS (*Pineapple Quart.* [*Hawaii. Pineapple Canners' Sta.*], *1* (*1931*), *No. 1*, *pp. 26–39*, *fig. 1*).—Tabulated data accompanied by discussion are presented on the results of sugar, acid, color, texture, and flavor determinations on the canned fruit of seedling pineapples developed in the breeding work of the experiment station. Some of the fruits were found to yield a product equal to or even superior to that of the Cayenne variety. It was an interesting fact that the Cayenne variety was one parent of all the promising hybrids.

Carnations for everyman, M. C. ALLWOOD (*London: Country Life, Ltd.; New York: Charles Scribner's Sons, 1931, pp. X+95, pls. 15*).—A popular discussion.

Effects of hardening chrysanthemum plants, G. W. WOODBURY (*Michigan Sta. Quart. Bul.*, *13* (*1931*), *No. 4*, *pp. 199–203*, *figs. 2*).—Using six varieties, Yellow Rager, Pink Chieftain, Gladys Pearson, Dr. Enguehard, Nellie T. Ross, and Major Bonnaffon, young plants of good condition were subjected from June 1 to June 24 to a lack of water sufficient to cause some of the lower leaves to fall and to give all of the leaves a yellow tinge. At the same time plants of the same lot were given ideal growing conditions. Following treatment the plants of both lots were benched in a greenhouse and grown under 12 different cultural treatments. Records taken on the date of maturity of flower, size of flower, length of stem, and general quality showed certain slight differences, however, too small to be significant. The blooms from the hardened plants in all except one plat were slightly smaller but not inferior in quality. It is deemed likely that if the hardening had been extended to a later date injury might be more manifest.

Earlier blooming by shading chrysanthemums, A. LAURIE (*Ohio Sta. Bimo. Bul. 151* (*1931*), *pp. 129–132*).—The results are presented of experiments on the effect of abbreviating the length of day on the flowering of the chrysanthemum, a typically short-day plant. Reducing day length by 4 hours brought chrysanthemums into bloom from 22 to 56 days earlier than the controls, and though stem length was reduced the difference was not enough to render the flowers unsalable. The most favorable time to begin shading was one month after benching the plants. A reduction of from 5 to 6 hours in day length did not induce greater results. It is stated that shading must cease as soon as the terminal bud forms, since light is necessary for the proper opening of the flowers. Favorable results were also obtained with potted pompons and with stevia.

Studies of the genus Delphinium, E. I. WILDE (*New York Cornell Sta. Bul. 519* (*1931*), *pp. 107*, *figs. 19*).—The results are presented of a comprehensive study of the Delphinium based on the literature and upon the study of a large collection of species and varieties assembled at the university. Among phases discussed are botany, classification, pollination, general culture, including propagation, control of pests, etc. An extensive bibliography is appended.

Studies in North American violets.—II, The cytology of some sterile F_1 violet hybrids, R. BAMFORD and A. GERSHOY (*Vermont Sta. Bul. 325* (*1930*), *pp. 53*, *pls. 22*).—Following a presentation of general considerations (E. S. R., 59, p. 218), there are now offered the results of determinations of the chromosome numbers in parental species and in F_1 hybrids and the results of cytological

studies of the reduction divisions and pollen sterility in four species hybrids obtained by crossing.

The following numbers of diploid (2*n*) chromosomes were found: *Viola incognita* 44, *V. lanceolata* 24, *V. pallens* 24, *V. cucullata* 54, *V. silvatica* 40, *V. elatior* 40, *V. striata* 20, *V. incognita*×*lanceolata* 34, *V. pallens*×*cucullata* 39, *V. silvatica*×*striata* 30, and *V. elatior*×*striata* 30. The percentage of poor pollen and the frequent obliteration of the embryo sac prevented accurate determination of the haploid chromosome number in the hybrids.

Within a subsection of the genus, species with greater chromosome numbers had somewhat smaller chromosomes than did related species with lesser numbers. In cells of the hybrids the somatic chromosomes maintained their size differences to such a degree that the chromosomes of one species were distinguishable from the gametic complement of the other. The taxonomic and chromosome number relationships of the species used as parents for the hybrids under study were such that each cross represented a distinct type of genetic combination. Chromosome number relations per se are considered merely as an accompanying feature of fertility and sterility. A similarity was observed between the effects of external factors and of hybridization as agencies creating disturbance in the course of nuclear and cell divisions. The inadequacy of the conception that pairing of homologous chromosomes is the crux of the incompatibility problem is discussed.

Hardy perennials for landscape planting in Michigan, C. P. Halligan (*Michigan Sta. Circ. 136 (1931), pp. 78, figs. 50*).—Cultural and descriptive information of a general nature is presented for a large number of perennials arranged alphabetically.

A survey of the United States bulb industry, R. G. Hill (*U. S. Dept. Agr., Bur. Agr. Econ., 1931, pp. [2]+55, pl. 1.*)—This is a mimeographed preliminary report of a survey made to locate districts of production and the kind and quantity of bulbs produced and to study the distribution and marketing practices in the industry in the United States.

FORESTRY

Concerning the significance of the seed source of our forest trees, F. Fankhauser (*Jour. Forestry, 29 (1931), No. 5, pp. 652–660, figs. 7*).—Citing the results of various European experiments and observations, the author concludes with the statement that "the forest will yield us the greatest and most valuable volume of wood permanently only if we reproduce it by natural seeding, or, where this is impossible, if we use in its reestablishment seed which has been collected as nearly as possible in the vicinity of the planting site."

Rapid methods of determining the percentages of fertility and sterility in seeds of the genus Betula, C. F. Patterson and A. C. Bunce (*Sci. Agr., 11 (1931), No. 10, pp. 704–708, figs. 6*).—Pointing out the fact that the percentage of viability in birch seed varies widely and that some trees produce all sterile seed while others yield fairly fertile material, the authors briefly outline two methods of seed examination based on appearance in transmitted light which were successful in revealing the viability of birch seed. With the aid of a medium power microscope, seeds spread thinly over a glass plate through which was reflected artificial light were observed to differ sharply. Fertile seeds appeared uniformly opaque, whereas in sterile seeds a dark line running from base to apex was observed in the middle of each seed. Fairly good results were secured without a microscope by simply spreading the seeds over a sheet of paper placed between the eye and strong light. The results were checked by actual germination tests and found to be highly accurate.

A new principle in seed collecting for Norway pine, C. G. BATES (*Jour. Forestry, 29 (1931), No. 5, pp. 661–678, figs. 4*).—From general observations and studies of lots of seedlings grown from seed the original source of which was known, the author believes that the strength of Norway pine (*Pinus resinosa*) seeds and the vigor and hardiness of the resulting seedlings vary inversely with the vegetative vigor of the parent trees. Apparently in a strong growing, comparatively young tree the food produced by the tree or that taken in from the soil, or both, is not sufficient to produce both vegetative growth and strong seeds. The more desirable seed cones were relatively small, purplish in color, and solid.

External polarity potentials in the apex of the Douglas fir before and after mechanical stimulation, E. J. LUND (*Plant Physiol., 6 (1931), No. 3, pp. 507–517, figs. 4*).—Working with actively growing, freshly cut Douglas fir tips whose lower ends were immersed in water, the author found that in the normal unstimulated condition the main apex of a lateral branch maintains an electropositive condition to all points on the branch below. The main apex was electropositive in the external circuit to each of the apexes of the first pair of lateral shoots. The usual range of variation in electric polarity was greater in the unstimulated apex than in the more basal parts of the lateral branch. As in the roots, spontaneous variations in electric polarity were observed in all apical growing points which could not be accounted for. Mechanical stimuli applied to any apex temporarily influenced electric polarity. The author suggests that the physicochemical mechanism of maintained electric polarity is the same as, or at least is a mechanism linked with, the mechanism of irritability of living cells.

The layering habit in Sitka spruce and the two western hemlocks, W. S. COOPER (*Bot. Gaz., 91 (1931), No. 4, pp. 441–451, figs. 4*).—Observations made at Glacier Bay, Alaska, in the summer of 1929 showed that the hemlocks *Tsuga heterophylla* and *T. mertensiana* propagated themselves to a certain extent by layering of the lower branches, although the tendency was not nearly as great as in the Sitka spruce. The anatomy of the layering branches was studied and used as a basis of determining the life history of the process of layering.

The timber of Corsican pine (Pinus laricio Poiret) (*[Gt. Brit.] Dept. Sci. and Indus. Research, Forest Prod. Research Bul. 6 (1930), pp. VII+40, pls. 4, figs. 15*).—This report presents the results of an initial series of investigations into the structure of Corsican pine wood, its seasoning qualities, strength, woodworking properties, and its uses.

The experiments demonstrated clearly that Corsican pine timber of the quality used can be kiln-seasoned rapidly and easily with very slight structural damage. It is extremely tolerant of high temperatures. There is a general tendency for the knots to split, but this does not detract from the value of the timber for most of the uses to which it is likely to be put. Corsican pine can be readily seasoned when piled in stick in the open. The degrade under severe conditions has been found to be less than that resulting from normal kiln-drying, which itself is small.

The timber has a mechanical strength of an average value among the pines of medium density. When well grown it is almost as strong as Scots pine, and when so grown may be considered as superior to the latter timber in strength when used as a post or column. The timber is not as heavy as Scots pine, nor is it usually so hard, which would indicate that it is easier to work. The timber does not shrink nor swell either in the radial or tangential direction as much as Scots pine, and this property associated with its disinclination to cup or warp would make it a more useful timber for certain classes of

joinery. The timber is inclined to be brittle, especially when air-dry, and should not be used in positions where it would be subjected to sudden shocks.

The fiber saturation point of the timber is at about 27.5 per cent moisture content. There is no shrinkage until this point in seasoning is reached. When the strength of the timber in compression parallel to grain is compared on a basis of rate of growth, it is found that the optimum condition to produce strong timber is a rate of growth corresponding to about 10 rings to the inch.

It was found that there was no difficulty in injecting creosote or water solutions into Corsican pine. In fact, it is considered that this species is more amenable to treatment than Scots pine and is probably the easiest species to treat of the more common conifers. The timber can be treated successfully either under pressure or by the open-tank process, but it is especially suitable for an empty cell treatment as a deep penetration can be obtained in conjunction with a large recovery of injected oil.

Logging slash and forest protection, R. Zon and R. N. Cunningham (*Wisconsin Sta. Research Bul. 109 (1931), pp. 36, figs. 22*).—In presenting the results of a survey of the slash situation in northern Wisconsin it is stated that slash from 1 to 5 years old covers an area of approximately 540,000 acres, with another 100,000 acres covered with older slash still a partial fire menace. The present accumulation of slash is deemed the largest that will ever be found in Wisconsin. Slash is considered less inflammable than dry grass or leaves but when fired is more difficult to control. Clean cutting creates the greatest amount of slash which remains a fire hazard for about 8 years. Selective logging, on the other hand, leaves less slash with a shorter fire hazard, 3 to 4 years. Close utilization obviously reduces the amount of slash and the fire hazard. A program for solving the slash problem is outlined.

Ohio Forest News, [July, 1931] (*Ohio Forest News [Ohio Sta.], No. 14 (1931), pp. 8, figs. 4*).—Notes are presented on various forestry activities, including planting, fire control, and clubs.

DISEASES OF PLANTS

Plant pathology.—Mycology and bacteriology (*East Malling [Kent] Research Sta. Ann. Rpt., 16 (1928), pt. 1, pp. 97–101*).—This account includes brief details regarding successful inoculations with crown gall organism strains isolated from a dock and from a raspberry stem; brown rot inoculations on pear flowers, one successful from plum twig, two inconclusive from cherry; effect of root stock on scion susceptibility to apple scab and apple mildew; the pathology of raspberry and loganberry to blue stripe wilt, *Verticillium dahliae* (?), raspberry cane spot, and loganberry spot (*Plectodiscella veneta* ?), raspberry mosaic, spur blight, and other cane diseases (*Cryptosporium minimum* and *Microthyriella rubi*); plum and cherry tree bacteriosis; wilt of hop (*V. alboatrum*) and of rhubarb (*Verticillium* sp.); bacteriosis of walnut; apple scab and mildew trials; apple spray injury (1928) and apple blister canker (*Coniothecium chomatosporum*).

Diseases and pests of tropical cultivated plants and their control [trans. title], H. Morstatt (*Tropenpflanzer, 32 (1929), No. 12, pp. 491–500*).—A somewhat wide though brief review is given of plant pests and diseases, with emphasis on the importance of a few, as of the Hemileia causing coffee rust.

Plant diseases section, S. Youngberg (*Philippine Bur. Agr. Ann. Rpt., 28 (1928), pp. 75–78*).—This brief general account indicates the adoption and use of control measures for sugarcane diseases in the Philippine Islands; work attacking rice stem rot through the soil, seed, fertilizer, and planting management; and an identification service.

[Virus diseases in plants], V. Likhité (*Meded. Landbouwhoogesch. Wageningen, 33 (1929), Nos. 1, pp. 30, figs. 23, Dutch abs. pp. 26, 27; 2, pp. 12, Dutch abs. p. 12*).—This publication, in English, consists of two parts.

I. *The nature and relations of the intracellular inclusions present in the mosaic of tobacco.*—Vacuolate bodies have been found in all their life phases in tobacco stems affected with tobacco mosaic No. 1. They were found also in tomato, petunia, Hyoscyamus, and *Solanum nigrum* showing the same mosaic. Crystals accompanying these diseases, formed of the albuminoid material secreted by the vacuolate body, vary from polyhedral, striated to crescent form according to the age of the diseased part. No nuclear material was found in the vacuolate bodies. These bodies, which proved to be of mitochondrial structure, regenerate by division, fission, encystment, and sporulation. They are considered to be of animal nature. The term Vacuolarium is proposed for the genus and *V. iwanowski* for the specific organism causing tobacco mosaic No. 1.

II. *Cytological aspects of the virus diseases in plants.*—This second part is a review of the findings by authors cited as regards the several bodies and materials which have been found present in virus-sick plant cells.

Further studies on the attenuation of plant viruses, J. Johnson (*Phytopathology, 18 (1928), No. 1, p. 156*).—Submitting further information on virus diseases (E. S. R., 61, p. 537), the author states that little or no attenuation can be secured in the ordinary tobacco mosaic virus at temperatures below 34° C. (93.2° F.) by an exposure of 15 days, though at 38° a greater attenuation was obtained. Some of these attenuated viruses have remained attenuated after 10 serial transfers through tobacco or after storing in vitro for several months. The tobacco mosaic virus has also been attenuated by means of bubbling air and oxygen through the virus extract for several weeks, and the same virus has been secured in a naturally attenuated form from several soils in which it had overwintered. The cucumber mosaic virus on tobacco was attenuated by exposure to a temperature of 37° for 10 days. Attenuation of viruses appears rather sporadic and may not be secured in every case by any of these methods. Attempts to attenuate the potato rugose mosaic virus in a similar manner were unsuccessful.

Virus diseases observed by the Allison V. Armour Expedition, H. H. McKinney (*Phytopathology, 18 (1928), No. 1, p. 155*).—In the Canary Islands, wild *Nicotiana glauca* showed very prevalently mosaic symptoms, three types of which were a dark green, a light green, and a yellow which can be isolated also from the yellow spots associated with the light-green type. The dark-green type shows excessive chlorophyll production, the mottled areas being large but few in number. Mosaic was found also on *Psoralea bituminosa*, wild garlic, and potatoes.

In West Africa, mosaic was general on *Capsicum* sp. and on *Manihot esculenta*, an important food plant, appearing sometimes as a limiting factor in production. Yellow and green types were found on Cucurbitaceae (three species) and on other plants. Though wild grasses flourished in the Cameroon and sugarcane grew in all the colonies visited, no grass mosaic was found.

Two "stunting" diseases of wheat and oats.—Specimens desired by the Waite Institute, G. Samuel (*Jour. Dept. Agr. So. Aust., 32 (1928), No. 1, pp 40–43, figs. 3*).—Stunted patches in wheat and oat crops are described. They are said to be primarily indistinguishable as to causation, but referable (on washing out the roots) either to a nematode (*Aphelenchus* sp. ?), or to a fungus (*Rhizoctonia* sp. ?).

Bunt disease of wheat (and how to control it), E. Guest (*Iraq [Mesopotamia] Dept. Agr. Leaflet 19 (1929), pp. 1–6, pls. 3*).—Wheat bunt (locally

"Jālib") is described in comparison with loose smut as regards symptoms and transference, also a simple mechanism for dusting the seed protectively with copper carbonate, with an estimate of the cost. The efficacy of the treatment is shown by figures derived from three years' experiments at Rustam.

Blackarm disease of cotton: The development of Pseudomonas malvacearum E. F. Smith, within the cotton plant, R. E. Massey (*Empire Cotton Growing Rev., 6 (1929), No. 2, pp. 124–153, figs. 12*).—Since the publication of the previous paper (E. S. R., 60, p. 832) this work has centered mainly on the practical application in the field of the principles previously developed, and in the present paper a discussion is given of the habits of the parasite *P. malvacearum*, its growth requirements, and its location within the cotton plant. The influence of environmental factors on the progress of the disease has been considered, and explanation has been offered as to how it is possible for a plant apparently healthy to contain active infection and to transmit infected seed.

The effect of soil temperature on the development of the disease has been studied and confirmation gained of the results of earlier work. It is shown, however, that the immunity appearing as the result of exposure at 30° C. may not be real, 32° being requisite for certainty.

Explanation is given as to the value of dry-land farming and the effects of field sowing at different periods. Wind and rainfall, with other conditions present, suffice to explain the outbreak some 12 days after a rainstorm. The effect of induced waterlogging of infected tissues has been described, as also the effect in this connection of rainfall.

The relevant conditions found at the three main cotton-producing centers of the Sudan have been briefly noted, and the value of Tokar as a propagation area for clean seed has been emphasized. The influence of storage and the effect of dry heat on infected seed are discussed.

Blackarm disease of cotton, R. E. Massey and M. C. Hattersley (*Empire Cotton Growing Rev., 6 (1929), No. 3, pp. 248, 249*).—Reference was made in the paper by Massey, noted above, to the presence of organisms other than *Pseudomonas malvacearum* in the tissues of cotton plants. It is now stated that every natural infection examined during the previous three months proved to consist of two bacteria, one being the true *P. malvacearum*, the other a bacterium morphologically similar in early stages on nutrient agar but dissimilar in the character of the colonies on solid media and in liquid media containing sugars. Cultures contributed by other workers also proved to be a mixture of the two organisms.

Cotton diseases in Uganda, 1926–1928, Parts I–III, C. G. Hansford (*Empire Cotton Growing Rev., 6 (1929), Nos. 1, pp. 10–26; 2, pp. 160–167; 3, pp. 240–245*).—Cotton diseases and conditions dealt with more or less briefly for this period include sore shin (*Rhizoctonia solani; Corticium vagum*), angular leaf spot (*Bacterium malvacearum*), areolate mildew (*Ramularia areola*), other leaf diseases (*Mycosphaerella gossypina* with *Septoria* sp. as imperfect stage and *Alternaria longipedicellata*), root rot of mature plants (*Rhizoctonia bataticola*), wilt disease (*Fusarium vasinfectum*), internal boll rot (*Nematospora gossypii*), boll rot (*Bacterium malvacearum*), other boll diseases (several fungi and bacteria), mechanical boll injuries, and organisms (bacteria and fungi) internal to cottonseed.

The relation between flag smut infection and manurial treatment, H. C. Forster and A. J. Vasey (*Jour. Dept. Agr. Victoria, 27 (1929), No. 6, pp. 321–330, figs. 6*).—In observations and counts made on the occurrence of wheat flag smut (*Urocystis tritici*) under manurial treatments in the permanent manurial field at the State Research Farm, Werribee, there was found a close relation

between the application of lime up to 10 cwt. per acre and the percentage of flag smut infection. Local farmyard manure also favors infection, and in the case of the combination of farmyard manure and lime the infection is particularly severe. The 1928 observations showed no effect of the various superphosphate applications on the percentage of disease infection.

Brown-patch experiments and notations made at Kittansett Club, Marion, Mass., during season of 1927, A. B. Porter (*Bul. U. S. Golf Assoc. Green Sect., 8 (1928), No. 5, pp. 105–107*).—Because outbreaks of brown patch occurred regularly on some greens and not on others, experimentation was carried out in 1927 to study the corresponding conditions. This brown patch was the large size, 4 to 18 in. in diameter, the small or "dollar spot" not being common in Massachusetts.

The method is detailed of using the three principal fungicides employed, Semesan, Uspulun, and Calogreen, each of which was effective up to about 10 days in rainy weather. Results from other chemicals were not decisive. Damp conditions appeared to be disadvantageous.

Late blight and rot of potatoes caused by the fungus Phytophthora infestans (Mont.) de Bary, R. R. Hurst (*Canada Dept. Agr. Bul. 119, n. ser. (1929), pp. 13, pls. 2, figs. 6*).—Potato late blight (*P. infestans*) is often an important factor in the reduction of potato yields in Canada, both destroying the tops prematurely and rotting the tubers. In Prince Edward Island, late blight was chiefly responsible for a reduction in yield amounting to 130.5 bu. per acre during a 5-year investigation. Other losses are outlined. In addition, often as much as 50 per cent of the crop is rendered unmarketable by this disease. The control measures here recommended in some detail are based upon the principle of prevention by the use principally of Bordeaux mixture.

"Glassy end" of potatoes, F. Penman (*Jour. Dept. Agr. Victoria, 27 (1929), No. 8, pp. 449–459, figs. 3*).—The potato crop of 1927–28 showed in numerous places a condition known as glassy end, which is described with references. The condition, which does not appear to improve or grow worse during storage, is supposed to be produced by excessive second growth. This requires more material, chiefly carbohydrate, than can be supplied by the aerial system of the plant injured by desiccation during the hot weather. Only varietal breeding is suggested.

The control of a serious potato trouble, E. E. Edwards (*Jour. Min. Agr. [Gt. Brit.], 36 (1929), No. 3, pp. 234–242, pls. 2*).—For some years, potato interests in Lincolnshire, Yorkshire, Lancashire, and other English counties have suffered loss from a somewhat obscure cause termed potato sickness, eelworm, or potato dab, the loss at times being almost total. The symptoms are described. The roots and underground stems bear numbers of cysts of *Heterodera schachtii* and a considerable infection of *Corticium* (*Rhizoctonia*) *solani*. Incomplete experimentation indicates the effectiveness of these agents in causing the trouble.

Results of tests as tabulated are thought to indicate that "drained creosote salts" are worthy of further trial. It is suggested that this chemical should be broadcast 12 days before planting the potatoes at the rate of about 8 cwt. to the acre and immediately plowed in to a depth of 6 in.

Comparison of various disinfectants in the treatment of sweet potatoes for black rot control: A progress report, O. C. Boyd (*Phytopathology, 18 (1928), No. 1, pp. 153, 154*).—In a season favorable throughout for black rot, Porto Rico sweetpotatoes were heavily inoculated with conidia, ascospores, and chlamydospores of *Ceratostomella fimbriata*, then each subjected to one of several treatments listed, dried, and bedded. The results are tabulated as to the

percentage of draws infected with black rot, percentage of bedded roots infected, and average number of lesions per bedded sweetpotato. In the uninoculated control, both draws and bedded roots were clean. Inoculated control draws showed 25.8 per cent and bedded roots 96.5 per cent infection.

Low infections of draws as correlated with treatments included 9.2 per cent for mercuric chloride 0.2 per cent dip and for Corona Copper Carb dust (20 per cent copper), 9 per cent for Semesan Bel 1–20 dip, and 7.1 for Lucas-Kil-Tone Bordo Powder dust (22 per cent copper).

The number of draws produced under the various treatments was not consistently related to the amount of black rot on either sweetpotatoes or draws. No disinfection injury was noted.

Phytopathological observations [trans. title], D. TOLLENAAR (*Proefsta. Vorstenland. Tabak* [*Dutch East Indies*], *Meded. 62* [*1929*], *pp. 28–39, pls. 3, figs. 3*).—An account is given of the outbreak of tobacco mosaic at different places, also of a leaf perforating disease, supposedly new, with other injuries connected with the presence of insects.

Experiments with tomato streak, W. G. STOVER (*Phytopathology, 18* (*1928*), *No. 1, p. 154*).—Streak was induced by inoculating tomato plants with extract from mosaic tomato along with extract from potato plants having mild mosaic, rugose mosaic, leaf roll, or spindle tuber, and sometimes from apparently healthy potato plants. Streak was not induced when normal seedling potato plants were used as one source of inoculum, though it was induced in the tomato when the potato seedlings had been previously inoculated with potato mosaic. Streak was also induced by inoculating the tomato with juice from mosaic tomatoes together with juice from either the tomato or black nightshade previously inoculated with potato mosaic.

Streak is transmissible from streak-infected tomato through tobacco or black nightshade back to the tomato. It developed in tomato plants inoculated from either tobacco or black nightshade which had previously been double inoculated with tomato mosaic and potato rugose mosaic, and also in tomato plants inoculated with tomato mosaic and potato mosaic on widely separated dates.

The streak virus mixture may occur in any part of the diseased plant or may be absent from certain organs. The potato element becomes noninfective in a short time after the death of the affected tissue, while the tomato element may remain infective for some time.

Successful control of apple scab in the Wisbech area, F. R. PETHERBRIDGE, W. A. R. DILLON WESTON, and W. G. KENT (*Jour. Min. Agr.* [*Gt. Brit.*], *36* (*1929*), *No. 1, pp. 45–51, pl. 1*).—In the Wisbech district of England apple scab is said to be an important cause of loss. The present account presents the outcome of carrying out a part (2 years) of a 3 years' spraying program.

An area of Worcester Pearmain trees at Wisbech has shown an average profit of nearly £50 per acre after spraying with homemade excess lime-Bordeaux mixture and with half-strength excess lime-Bordeaux mixture. Lime sulfur gave an average profit around £37 10s. per acre for the year. The spraying cost was about £4 per acre in 1927 and £6 in 1928. The control plats showed a loss. The data are said to explain why many Worcester Pearmains in the Wisbech district are unprofitable after they reach a certain age. Tar oil spraying alone had very little effect.

Scab or shot hole of apricots: Control experiments in the Goulburn Valley, S. FISH (*Jour. Dept. Agr. Victoria, 26* (*1928*), *No. 5, pp. 310–312, fig. 1*).—Apricot scab or shot hole (*Coryneum beijerinckii, Clasterosporium carpophilum*) under conditions prevailing in the Goulburn Valley was reduced from 46.7 to 6.6 per cent by the use of two sprayings with Bordeaux mixture at

6-4-40 with the addition of 0.4 lb. of lime casein spreader. One spraying was applied before or after leaf fall, the other at the pink-bud stage.

Apricot scab or shot hole: A synopsis of three years' work on control conducted in the Goulburn Valley, S. Fish (*Jour. Dept. Agr. Victoria, 27 (1929), No. 4, pp. 235–239, figs. 2*).—The treatment indicated above as beneficial in 1927 was found in 1928 to reduce the percentage of scabby apricot fruit as low as 2.2 per cent.

On trees unsprayed for three years 77.7 per cent of the yield was scabbed, as compared with 2.3 per cent on trees sprayed with Bordeaux mixture in the autumn and at the pink-bud stage in the spring. The total cost was 7d. (14 cts.) per tree. The use of spray at these stages did not depress the yield or blemish the crop.

Rind marking of citrus fruits, S. A. Cock (*Jour. Dept. Agr. Victoria, 26 (1928), No. 9, pp. 549–556, figs. 3*).—Citrus fruit rind marking, negligible in normal seasons though sometimes factoring in export, was found to be caused by wind- and rainstorms. When wet with rain or dew, the rind of the fruit is soft and if rubbed is liable to develop the blemishes known as silver rust and scurf. The effects of pruning on the rind markings are to be ascertained.

Two blackroot fungi in Hevea [trans. title], W. Bally (*Meded. Proefsta. Malang, No. 68 [1929], pp. 17, pls. 3, figs. 6; Eng. abs., pp. 12, 13*).—In a garden two years old of interplanted coffee, lamtoro (*Leucaena glauca*), and Hevea, where many of the first two plants had been killed by *Rosellinia bunodes*, a young Hevea was found to be severely infected. The attack and fructifications are described. A possible relation with the acidity of the soil is being investigated.

Preliminary note on a fungus isolated from diseased coffee trees in south Sumatra [trans. title], H. R. A. Muller (*Arch. Koffiecult. Nederland. Indië, 3 (1929), No. 3, pp. 167–181, figs. 7; Eng. abs., pp. 173, 174*).—A fungus attacking coffee trees in south Sumatra was isolated by a method which is described in detail, with comparative accounts. Though no fructifications have been observed, a study of the hyphae is considered to justify its inclusion in the genus Rhizoctonia.

Further studies on the host range of aster yellows, L. O. Kunkel (*Phytopathology, 18 (1928), No. 1, p. 156*).—A continuation during the year (employing *Cicadula sexnotata*) of the study of aster yellows (E. S. R., 60, p. 836) has extended the known host range by experimental transmission to 21 species in 13 different families, making more than 70 species in 28 different plant families. Most of the new hosts are cultivated flowering plants. Many species closely related to susceptible ones are immune. It has been found that aster yellows is distinct from witches'-broom of potatoes and from a boneset (*Eupatorium perfoliatum*) yellows disease.

The "shab" disease of lavender, C. R. Metcalfe (*Jour. Min. Agr. [Gt. Brit.], 36 (1929), No. 7, pp. 640–645, pls. 2*).—An extensive investigation of the "shab" disease of lavender in the Cambridge University Botany School and in commercial lavender plantations has confirmed the causal agency of the fungus indicated by Brierley (E. S. R., 36, p. 851). The symptoms and mode of development of this disease are described, and it is admitted that similar symptoms have sometimes been produced by unfavorable living conditions.

Phoma lavandulae has been found to invade lavender plants either through the leaf axils on young stems or through freshly made wounds. It is spread widely by the dispersal of pycnidia-bearing fragments, cuttings from diseased plants, or the splashing of spores due to rain.

Most varieties of lavender are susceptible to the disease, but Dwarf French is immune, though useless for perfumery.

P. lavandulae has been found to grow saprophytically on dead remnants of *Chenopodium album* and to be transferable to lavender from this source. Control measures are described.

Nematology observations on station experiment No. 15, G. H. GODFREY (*Pineapple Quart.* [*Hawaii. Pineapple Canners' Sta.*], *1* (*1931*), *No. 1, pp. 50–52*).—Using as indicator plants susceptible cowpeas grown in pots of soil collected from the several plats composing an organic matter experiment noted on page 640, the author found that nematodes survived the period between crops on all the plats. Observations on the roots of pineapple plants 16 months after planting showed great variation in infestation, from 0 to 95 per cent of all roots being attacked by Heterodera and from 0 to 85 per cent by Tylenchus. Very few of the plants were in the zero class. Irrespective of treatment, all plats were severely infested with the nematodes.

Some experiments on nematode control by clean fallow.—Preliminary report, G. H. GODFREY and H. R. HAGAN (*Pineapple Quart.* [*Hawaii. Pineapple Canners' Sta.*], *1* (*1931*), *No. 1, pp. 10–18, fig. 1*).—Knowing that the life history of nematodes was completed in summer in 17 days from the time seed was planted as compared with 35 or more days in winter, careful observations were made on nematode life in fields in which clean fallow was maintained. Certain leaks in effectiveness of treatments were noted, namely, weeds left in the soil long enough to permit nematode propagation and the growth of volunteer pineapples with similar propagation of nematodes. The removal of pineapple refuse greatly aided in reducing nematode reinfestation. Despite some unsatisfactory results by growers, the authors confidently believe that the elimination of nematodes is possible where weeds and volunteer pineapples are completely suppressed.

ECONOMIC ZOOLOGY—ENTOMOLOGY

Life history studies of the Wyoming ground squirrel (Citellus elegans elegans) in Colorado, W. L. BURNETT (*Colorado Sta. Bul. 373* (*1931*), *pp. 23, figs. 7*).—This report of studies of the Wyoming ground squirrel in northwestern Colorado, where it is known to occur in 14 counties, is based upon notes taken in the field during a period of several years. An account of control work has been noted (E. S. R., 63, p. 153). Following an introduction and discussion of the genus Citellus, the author takes up the history of the species, its distribution in Colorado, distribution at the present time by counties, breeding, food and feeding habits, and cultivated plants fed upon, and presents random notes.

The observations show the native food of this ground squirrel to be mostly grasses, other plants being fed upon incidentally as if for a relish. When the squirrels feed on grass heads, they pull the heads within reach with their fore paws, while standing erect. The squirrels on grassland do not eat their fill at one place, but run from plant to plant, even of the same species, eating a few blades of each. Some of the squirrels in these feeding operations cover considerable territory.

The laboratory mouse—its origin, heredity, and culture, C. E. KEELER (*Cambridge: Harvard Univ. Press, 1931, pp. VIII+81, figs. 36*).—This work deals with the subject under the headings of geographical distribution of the house mouse, antiquity of the fancy mouse, unit characters (gene mutations) of the house mouse, normal inheritance, abnormal inheritance, and the breeding of mice in laboratories. A bibliography of 184 titles is included.

Key catalogue of parasites reported for Chiroptera (bats) with their possible public health importance, C. W. STILES and M. O. NOLAN (*U. S. Pub. Health Serv., Natl. Inst. Health Bul. 155* (*1930*), *pp. 603–742*).—Following an introduction, the classification of parasites of bats is dealt with, the arrangement being alphabetical by genera and species.

Birds of the Bermudas (*Hamilton: Bermuda Book Stores, [1931], pp. 55, figs. 30*).—This small handbook describes 9 birds native to Bermuda, 23 regular visitors, and 9 occasional visitors, and illustrates 30 of these in colors. It is pointed out that less than a dozen birds are true residents, the rest being migratory in April and October of each year. Nearly 200 species have been identified in Bermuda which reach the islands in the course of their migration or are blown from the mainland by contrary winds.

Social behaviour in insects, A. D. Imms (*London: Methuen & Co., 1931, pp. IX+117, figs. 20*).—An outline is given of the essential features of the structure and habits of social insects, the main paths which their evolution has traversed, and the basis upon which their behavior depends.

The bearing of the oxytofactor in insect control, W. D. Pierce (*Jour. N. Y. Ent. Soc., 39 (1931), No. 2, pp. 159–165*).—In this discussion of hydrogen ionization, to which the name oxytofactor is applied, the author outlines practices and principles which it is maintained would aid materially in the proper solution of problems of control of an undesirable species, organism, plant, or animal.

[Economic insects and their control in New Jersey] (*N. J. State Hort. Soc. Proc., 1930, pp. 43–65, 152–162*).—The contributions on economic entomology presented at the annual meeting of the New Jersey State Horticultural Society (E. S. R., 64, p. 155), held at Atlantic City, N. J., in December, 1930, include Fruit Insects in 1930, by T. J. Headlee (pp. 43–65), and Important Insects of 1930 and Suggested Control Measures for 1931, by R. C. Burdette (pp. 152–162), both from the New Jersey Experiment Stations.

[Contributions on economic insects in Spain] (*Bol. Patol. Veg. y Ent. Agr. [Madrid], 4 (1929), No. 15–18, pp. 1–92, figs. 68; pp. 117–126, figs. 12; pp. 145–156, figs. 10*).—The contributions here presented are as follows: The Lepidopterous Enemies of Corn, by D. Delgado de Torres (pp. 1–20); Control Experiments with the Mediterranean Fruit Fly (*Ceratitis capitata*) with Glass Bait Traps, by F. Gómez Clemente (pp. 21–38); Notes on the Alfalfa Weevil (*Phytonomus variabilis* Herbst.), by M. Benlloch (pp. 39–42); Thysanoptera Injurious to Wheat, by J. del Cañizo (pp. 43–48); Parasites of Aphids: Two New Species of Aphidius [*A. gomezi* and *A. janinii*], by M. Quilis Perez (pp. 49–64); Dipterous Parasites of the Grasshopper [*Dociostaurus maroccanus* Thumb.] in Spain, by D. Delgado de Torres (pp. 65–68); The Propagation of *Novius cardinalis* in Spain, by F. Gómez Clemente (pp. 69–83); An Experiment in Combating the Beet Flea Beetle (*Chaetocnema tibialis* Illig.), by L. Ridruejo (pp. 84, 85); Chemical Analyses of the Nicotine Insecticides, by P. Herce (pp. 86–92); The Lepidopterous Enemies of Orchard Fruits, by M. Benlloch and J. del Cañizo (pp. 117–126); The Grapevine Flea Beetle (*Haltica ampelophaga* Guér.), by A. García López (pp. 145–151); and The Alfalfa Beetle (*Colaspidema atrum* Olivier), by F. Gómez Clemente (pp. 152–156).

Report of the Imperial entomologist, P. V. Isaac (*Imp. Inst. Agr. Research, Pusa, Sci. Rpts., 1929–30, pp. 72–79, pl. 1*).—This report includes a brief account of observations of some of the more important pests of the year.

Report of the chief entomologist for the year 1930, R. W. Jack (*South. Rhodesia Dept. Agr. Rpt. Sec. 1930, pp. 65–73*).—In addition to a brief account of the more important insects of the year, particular attention is given to insects of medical and veterinary importance.

Insects observed on crops in South Australia during period June, 1928, to June, 1930, J. Davidson (*Jour. Dept. Agr. So. Aust., 34 (1931), No. 7, pp. 741–745*).—A report on the important pests of the year, arranged by crops attacked.

The investigations on some injurious pepper insects in the Dutch East Indies [trans. title], J. van der Vecht (*Landbouw [Buitenzorg], 6 (1931), No.*

8, pp. 820–828; Eng. abs., pp. 827, 828).—This is a preliminary account of the more important insect enemies of pepper in the Dutch East Indies.

Insects in relation to potato virus diseases, K. M. Smith (*Jour. Min. Agr. [Gt. Brit.], 37 (1930), No. 3, pp. 224–232, pls. 4; also in Agr. and Livestock in India, 1 (1931), No. 1, pp. 58–64*).—This is a review of knowledge of the subject.

The first report of the rice insects of Lanchi district [trans. title], J. C. Lou (*Chekiang Prov. Bur. Ent., Misc. Pub. 5 (1930), pp. 2+3+[30], pl. 1, figs. 11; Eng. abs., pp. 3*).—A report of observations of 14 of the more destructive insect enemies of paddy rice in the Chekiang Province of China.

Pests of apple and pear in Michigan, R. H. Pettit and R. Hutson (*Michigan Sta. Circ. 137 (1931), pp. 63, figs. 60*).—This is a practical summary of information on the common insect and mite enemies of the apple and pear in Michigan.

Two destructive insects of carnation plants (Epichorista ionephela Meyr. and Chloridea obsoleta), D. Gunn (*Union So. Africa Dept. Agr. Bul. 94 (1931), pp. 9, figs. 5*).—This is an account of the occurrence of the corn ear worm and the carnation worm (*E. ionephela*), frequently a source of extensive damage to carnation plants throughout the Union of South Africa.

Effect of certain radio waves on insects affecting certain stored products, J. Hadjinicolaou (*Jour. N. Y. Ent. Soc., 39 (1931), No. 2, pp. 145–150*).—In this contribution from the New Jersey Experiment Stations, the author concludes that "certain insects subjected to high-frequency radio waves are killed on account of the internal temperature, which reaches a lethal point. Larvae of *Plodia interpunctella* affecting dry figs, apricots, etc., and larvae and pupae of *Sitodrepa panicea* affecting ground pepper are killed when subjected to these waves for a period of time ranging from 2 minutes to 2 minutes and 30 seconds. All stages of the bean weevil (*Bruchus 4-maculatus* Fab.) are destroyed when subjected for 5 minutes to a frequency of 1,087,000 cycles per second with a field strength of 4,000 volts per linear inch. Treated seeds do not lose their germinating power. They may be planted and thus the damage due to infestation is eliminated."

Oil sprays for summer use, A. Spuler, F. L. Overley, and E. L. Green (*Washington Col. Sta. Bul. 252 (1931), pp. 39, figs. 8*).—This is a progress report of investigations of summer oil sprays conducted for four years in the Wenatchee district in cooperation with the county commissioners of Chelan County and the Wenatchee Valley Traffic Association. The work is considered under the headings of specifications for summer oils, value of oil in insect control, relation of insect injury to reduction in leaf area, and arsenical residue removal.

The authors find that oils of low refinement, that is, with a sulfonation value of 50 per cent, are not suitable for summer use, since they are more or less toxic to plant foliage. "Highly refined oils are not toxic to foliage in the sense that leaf tissue is destroyed, but they do under certain conditions interfere with leaf metabolism. The method of refinement, whether by sulfuric acid or by liquid sulfur dioxide, is not important from the standpoint of plant injury. Within certain limits the insecticidal value of an oil increases with viscosity. The injurious effect of oil on plants also increases with the viscosity of the oil."

It was found that "the accumulation of starch was greater in oil-sprayed leaves than in leaves sprayed with lead arsenate and was greatest in leaves sprayed with the heavy oils (viscosity 110–120). This accumulation was perhaps due to a clogging of conducting vessels by the oil, particularly in the case of the heavy oil.

"Trees with heavy loads of fruit sprayed with six applications of medium (viscosity 70–75) to heavy (viscosity 110–120) oils showed a reduction in size of fruit. Comparisons of fruit in plats sprayed by various oil emulsions were made by first limiting the leaf area on all fruit measured to 20 leaves per apple. Three applications of a light oil (viscosity 50–55) aided tree growth by controlling red spider. Fruit on trees receiving these sprays was larger than on trees sprayed with lead arsenate. The type of emulsion, whether quick breaking or more or less stable, is relatively unimportant in summer oil from the standpoint of either insect control or plant injury. The type of emulsion has an important bearing on spray combinations in which oil is used with lead arsenate. Oils emulsified by the use of casein and ammonium hydroxide cause a pronounced flocculation of the lead arsenate particles when combined with brands of lead arsenate containing no deflocculator. This emulsion did not increase the water-soluble arsenic in any of the lead arsenates analyzed. Certain more stable oil emulsions did not cause a flocculation of the lead arsenate particles with any of the brands of lead arsenate used, but were instrumental in increasing the water-soluble arsenic when used with some brands of lead arsenate that contained a deflocculator. Trees sprayed with the latter combination showed severe arsenical burning of both foliage and fruit. The use of lime or a spreader containing lime with an oil-lead arsenate combination has prevented arsenical burning.

"Oil sprays are valuable in the control of codling moth, leafhopper, aphids, red spiders, and migrating San Jose scale. Oil sprays are not effective in codling moth control when used alone and should be combined with either lead arsenate or nicotine sulfate. The oil-lead arsenate combination is a very effective spray treatment for codling moth control in that the oil will kill from 80 to 95 per cent of the codling moth eggs and at the same time improves the spray coverage of the lead arsenate which renders it more effective. Because of their ovicidal value oil sprays should be applied at the height of the egg-laying period in both broods. Two applications at this time are as effective as three applications in the first brood cover sprays. Oil sprays should not be used in combination with lead arsenate after July 15, since this combination in late applications makes cleaning of the fruit difficult.

"The combination oil and nicotine sulfate has been as effective in preventing worm entry as lead arsenate (2–100) when used in any or all of the cover sprays. It has been decidedly more effective than lead arsenate in preventing stings. The nicotine sulfate oil combination is most valuable if used in second brood applications. Its use at this time does not increase the cleaning problem since no lead arsenate is used. The use of oil-lead arsenate and fish oil-lead arsenate sprays in the first brood and nicotine sulfate and oil in the second brood cover sprays forms a very effective spray program for the control of codling moth, red spider, aphids, and leafhoppers.

"Oil sprays, particularly those of high viscosity, cause metabolic disturbances in the foliage, which is reflected in decreased size and color of fruit. The extent to which these disturbances decrease the size and color of fruit is dependent on the load of fruit on the trees, the soil moisture, and the variety of fruit."

The control of capsid bugs on black currants, L. N. Staniland, F. Tutin, and C. L. Walton (*Jour. Min. Agr. [Gt. Brit.], 37 (1930), No. 5, pp. 475–480, figs. 2*).—In preliminary experiments with the common green capsid bug (*Lygus pabulinus*) and the apple capsid bug (*Plesiocoris rugicollis*), practically complete control was obtained from the application of a 10 per cent concentration of a winter wash consisting of a mixture of high boiling, neutral tar oil and a heavy paraffin oil.

The control of the common green capsid bug on red currants, F. R. Petherbridge and G. L. Hey (*Jour. Min. Agr.* [*Gt. Brit.*], *37* (*1931*), *No. 12, pp. 1185–1188*).—In experiments with *Plesiocoris rugicollis* one mineral oil emulsion tested gave a good commercial control while another gave only moderate control.

Some Erythroneura (grape leaf hoppers) of the Maculata group (Homoptera, Cicadellidae), R. H. Beamer (*Canad. Ent.*, *63* (*1931*), *No. 6, pp. 127–135*).—Twelve species of grape leafhoppers are noted, of which nine are described as new to science.

The Lecanium scale, an insect affecting fruit and shade trees on the Pacific coast, R. Glendenning (*Canada Dept. Agr. Circ. 77* (*1931*), *pp. 4, figs. 4*).—This is an account of *Eulecanium coryli* (L.), introduced into British Columbia about 1903 and in 1923 reported for the first time as causing damage to maple and numerous boulevard trees in the streets of Vancouver.

A preliminary note on the white-fly of cottons in the Punjab, M. A. Husain (*Agr. Jour. India*, *25* (*1930*), *No. 6, pp. 508–526*).—The studies show that a white fly, *Bemisia gossypiperda*, is a serious pest of cotton, reducing the yield through nonformation and dropping of bolls, although very little is known as to the real nature of the injury it causes.

Results of insecticide tests for the control of codling moth and observations on codling moth activity during the season of 1930 in the Yakima Valley, Wash., W. S. Regan (*Berkeley: Calif. Spray-Chem. Co., 1931, pp. 22, fig. 1*).—This is a detailed report of 28 tests with various materials and combinations, including lead arsenate; Orthol-K light medium summer oil; Del Monte liquid spreader; Filmorex, a spreader of the "film building" or "colloidal" type, and two other commercial products of this nature; Silque spreader; hydrated lime; Blackleaf 40; and "Sheep Dip" (crude coal tar creosote).

"One of the spreaders tested appeared to give better results at the dosage of 0.5 lb. to 100 gal., with both the lead arsenate alone and in the lead-oil combination, while another commercial spreader of this type gave better results at the dosage of 1 lb. to 100 gal. . . . Tests with Orthol-K light medium, in combination with Ortho Lead Arsenate, in several of the applications gave almost perfect control of codling moth under severe conditions. . . . The light medium grade of Orthol-K showed little, if any, reduced efficiency at equal dosage over the medium Orthol-K. High-grade hydrated lime in the combination of Ortho Lead Arsenate and Orthol-K summer oil (not with the lead alone) gave a highly effective control for codling moth, verifying similar tests of the previous year. The 1 lb. in 100 gal. dosage of the hydrated lime in the combination appeared to give better results than a 0.5 lb. dosage. Results with the hydrated lime in the lead-oil combination were not materially superior to the colloid type of spreader in this combination. Reduced dosages of the lead arsenate (1½ lbs. to 100 gal.) in the lead-oil combination gave very good results. The use of Blackleaf 40 in combination with Orthol-K as a substitute for lead arsenate in late sprays gave fairly good results, and indicates the possibility of using this material for codling moth control where residue removal offers a serious problem. The use of 'Sheep Dip' in combination with Ortho Lead Arsenate was found to reduce rather than increase the effectiveness of the arsenical. The 'Sheep Dip' showed no noticeable effect as an ovicide or repellent."

Results of experimental tests for the control of codlin moth as carried on at the Blackwood Experimental Orchard, season 1929–30, R. Fowler (*So. Aust. Dept. Agr. Bul. 243* (*1930*), *pp. 15, fig. 1*).—Very satisfactory results are said to have been obtained during the season from the use of arsenate of lead and Fluxit in the last three sprays. Arsenate of lead alone was only slightly less effective than arsenate of lead and Fluxit. Arsenate of lead, two

calyx sprays and/or calyx and first cover, followed by three oil sprays, using either Volck or Alboleum, gave good results and reduced the arsenical trouble. The best results from the standpoint of codling moth control were obtained by the use of the lead arsenate and oil combination, but the present costs of these spraying oils seem to be almost prohibitive. The lead arsenate and oil combinations when mixed before spraying also left the highest percentage of arsenical residue per pound of fruit, and it was found most difficult to remove. These combinations are considered to owe their extra efficiency to the fact that they make a heavy coverage on the fruit, which is not readily washed off by rain or rubbed off by wind action.

A slight injury to the fruit follows the use of Volck and/or Alboleum, but the damage is not serious. Volck oil alone will control codling moth, but it seems to inhibit to some extent the color formation of the skins of red apples and causes a certain amount of rustiness, thereby detracting considerably from the general appearance of the fruit. From the viewpoint of effectiveness in codling moth control, Alboleum may be expected to give as satisfactory results as Volck. Arsinette alone gave very good results, but a suspicious amount of what may have been arsenical residue was noticeable on the fruit at packing time.

In a dry season like the last applications of oil tend to collect the dust on foliage and fruit to the detriment of both. Arsenical dusts do not seem to give satisfactory results in codling moth control. It is not advisable to omit the calyx spray. On the whole, in the apple-growing areas in South Australia there was a heavy crop of fruit with a naturally light infestation of codling moth during the season under review.

The oviposition habits of Feltia subgothica Haw. (Noctuidae, Lep.), W. V. BALDUF (*Ent. Soc. Wash. Proc., 33 (1931), No. 4, pp. 81–88*).—The author presents a summary of observations and notes from the literature relating to the egg-laying habits and development of the genus Feltia in general and of the dingy cutworm in particular.

Notes on Chrysopa oculata Say and its relation to the oriental peach moth (Laspeyresia molesta Busck) infestation in 1930, L. J. BRIAND (*Canad. Ent., 63 (1931), No. 6, pp. 123–126*).—The author finds that the chrysopids played an important part in Ontario in conjunction with the parasites and other natural factors in the remarkable reduction of the oriental fruit moth infestation throughout the Niagara Peninsula in 1930.

Studies on Platyedra gossypiella Saunders in the Punjab.—Part II, The sources of Platyedra gossypiella infestation, M. A. HUSAIN, S. S. BINDRA, L. and G. RAM, and D. RAJ (*Indian Jour. Agr. Sci., 1 (1931), No. 2, pp. 204–285, fig. 1*).—This report of studies of the sources of infestation of the pink bollworm is in continuation of the account previously noted (E. S. R., 61, p. 253).

Biology of Phthorimaea operculella in Uruguay [trans. title], A. ALVES DA SILVA (*Rev. Facult. Agron.* [*Montevideo*], *No. 4 (1931), pp. 57–73, figs. 7*).—An account of the potato tuber worm and its injury.

Two new Peruvian Microlepidoptera of economic importance (Gelechiidae and Oecophoridae), A. BUSCK (*Ent. Soc. Wash. Proc., 33 (1931), No. 3, pp. 59–63, figs. 6*).—*Gnorimoschema tuberosella*, reported as injurious to potatoes at Lima and Callao, Peru, and *Eucleodora cocae*, which feeds on the leaves of the coca plant (*Erythroxylon coca*) causing damage to an extent of 60 per cent of the harvest in the height of the season and to about 20 per cent in the winter months, are described as new.

The Hesperioidea of North America, A. W. LINDSEY, E. L. BELL, and R. C. WILLIAMS, JR. (*Jour. Sci. Labs. Denison Univ., 26 (1931), Art. 1, pp. 142, pls. 33*).—A synopsis of the skippers (E. S. R., 46, p. 247).

The agromyzid flies of some native pulses in Java [trans. title], P. van der Goot (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Inst. Plantenziekten, No. 78 (1930), pp. VIII+97, pls. 8; Eng. abs., pp. 81, 82*).—This is a report of studies, presented in connection with a list of 26 references to the literature.

The control of the cabbage root fly, H. W. Miles (*Jour. Min. Agr. [Gt. Brit.], 37 (1931), No. 12, pp. 1227-1231, pls. 4*).—The demonstrations reported give definite indications of the value of corrosive sublimate in combating the cabbage maggot, and it is considered as well worth adoption as a routine treatment where the method can be employed. Due to the cost of this treatment and the difficulty of application of the liquid, the method is considered unsuitable for application on a field scale.

A new parasitic fly of the genus Chaetophlepsis, R. T. Webber (*U. S. Natl. Mus. Proc., 78 (1931), Art. 20, pp. 4*).—Under the name *C. orbitalis* n. sp. the author describes a dipterous parasite reared from the chain-spotted geometer.

Notes on the bionomics and anatomy of Corizoneura longirostris Hardwicke, S. K. Sen (*Indian Jour. Vet. Sci. and Anim. Husb., 1 (1931), No. 1, pp. 24-28, pls. 4*).—Notes are given on the bionomics and anatomy of this tabanid.

On the thermotropism of the mosquitoes in oviposition [trans. title], O. Hecht (*Riv. Malariol., 9 (1930), No. 6, pp. 706-724, figs. 3; Ital. abs. p. 806, Fr. abs. p. 808, Eng. abs. p. 810, Ger. abs. p. 812*).—Through the use of a special apparatus, water of different temperatures was offered at the same time to mature female mosquitoes. It was observed that different species of mosquitoes prefer water of definite temperatures when they have an opportunity to choose, the malarial mosquito preferring from 22 to 29° C., never depositing its eggs above 32°, only seldom under 20°, and very exceptionally under 15°. On the contrary, *Anopheles bifurcatus* preferred essentially lower temperatures, namely, from 12 to 20°, and avoided 25° completely. The yellow fever mosquito preferred temperatures between 20 and 30°, yet the limits of the preferred zone are less definite than those observed in the malarial mosquito.

Notes on some natural enemies of the mosquito in Colorado, S. C. Bishop and R. C. Hart (*Jour. N. Y. Ent. Soc., 39 (1931), No. 2, pp. 151-157*).—This is a report of observations made in the course of biological field work in the San Luis Valley of Colorado in June, 1930, and records some predacious enemies of the mosquito which seem to have escaped notice.

New Jersey Mosquito Extermination Association, eighteenth annual meeting (*N. J. Mosquito Extermin. Assoc. Proc., 18 (1931), pp. 169+[2], pls. 2, fig. 1*).—The contributions presented at this meeting (E. S. R., 64, p. 160), held at Atlantic City, N. J., in February, 1931, include the following: Notes on the Biology of Mosquitoes of Eastern Canada, by C. R. Twinn (pp. 10-22); Mosquito Suppression in Canada in 1930, by A. Gibson (pp. 23-39); The Biology of the Important Economic Species of Mosquitoes Occurring in New Jersey, by T. J. Headlee (pp. 40-69); A Summary of Mosquito Control Accomplishments in New Jersey during the Past Year, by F. W. Miller (pp. 70-89); Mosquito Control Work: A Year Round Project, by R. Van Derwerker (pp. 90-99); Mosquitoes of the Southeastern United States and Their Economic Effects, by T. H. D. Griffitts (pp. 100-110); Practical Application of Pyrethrum Mosquito Larvicide, by R. L. Vannote and J. M. Ginsburg (pp. 111-120); New Developments in Mosquito Control in Nassau County, New York, in the Past Year, by R. H. Sammis (pp. 121-124); The Activities of the State Federation of Women's Clubs' Mosquito Control Committee, by H. N. Prickitt (pp. 124-127); What New York City Has Done and Plans to Do in Staten Island, by T. E. Preston (pp. 127-129); An Outline of the Various Inspection Methods

Employed by the County Mosquito Extermination Commissions, by J. B. Leslie (pp. 130–135); New Developments in Mosquito Control in Connecticut during 1930, by R. C. Botsford (pp. 146, 147); Mosquito Control Work by the United States at Raritan Arsenal, by M. A. Farlow (pp. 148–150); Mosquito Control on Salt Marsh Areas under Industrial and Real Estate Development, by J. E. Brooks (pp. 150–154); The Progress of Anti-Mosquito Work in Massachusetts, by C. S. Forbes (pp. 157–163); and What Has Been Done in Burlington County towards the Formation of a County Mosquito Extermination Commission and the Prospects of the Future in Mosquito Work, by E. G. Terry (pp. 166–169).

Transmission of typhus fever by fleas (*Science, 73 (1931), No. 1886, Sup., p. 10*).—Investigations conducted by R. E. Dyer and L. F. Badger in Baltimore, Md., have shown that fleas taken from rats may transmit typhus fever (Brill's disease).

The apple curculio, H. G. Andrewartha (*Jour. Dept. Agr. West. Aust., 2. ser., 8 (1931), No. 1, pp. 106–114, figs. 4*).—An account of *Otiorhynchus cribricollis*, a European pest which first came to attention in Australia in 1906.

A new leaf mining buprestid from the Canal Zone (Coleoptera), W. S. Fisher (*Ent. Soc. Wash. Proc., 33 (1931), No. 2, pp. 42, 43*).—Under the name *Pachyschelus psychotriae* the author describes a new buprestid taken from a larval mine in *Psychotria carthaginensis* Jacq. on Barro Colorado Island, Canal Zone.

The species of Anthonomus attacking pear in the Rhone Valley [trans. title], R. Pussard (*Rev. Path. Vég. et Ent. Agr., 17 (1930), No. 4, pp. 164–173, figs. 4; abs. in Rev. Appl. Ent., 18 (1930), Ser. A, No. 10, pp. 515, 516*).—An account is given of three species of weevils of the genus Anthonomus which attack pear in the Rhone Valley, namely, *A. pomorum* L., *A. cinctus* Redtb., and *A. spilotus* Redtb.

Hispa armigera Oliv., the armour weevil [trans. title], M. T. Jen (*Chekiang Prov. Bur. Ent., Misc. Pub. 3 (1930), pp. 2+2+[84], pls. 7; Eng. abs., pp. 2*).—An account, with observations of its life history, of one of the most destructive rice insects occurring in the Chekiang Province of China.

Insect pests of sugar cane.—VI, The weevil borers—the Hawaiian sugar cane borer, T. E. Holloway (*Facts About Sugar, 26 (1931), No. 5, pp. 209–211*).—This is a continuation of the account previously noted (E. S. R., 65, p. 246).

Biological studies of a cynipid, Biorhiza pallida Ol. [trans. title], F. Picard (*Bul. Biol. France et Belg., 65 (1931), No. 1, pp. 58–102, figs. 12*).—An extended account of studies of the biology of the cynipid *B. pallida*, which develops in the galls of the oak, presented in connection with a list of 55 references to the literature.

Sawflies of the sub-family Dolerinae of America north of Mexico, H. H. Ross (*Ill. Biol. Monog., 12 (1929), No. 3, pp. 116, pls. 6*).—Following a brief introduction and an account of the biology and phylogeny, the taxonomy and nomenclature of the subfamily Dolerinae are dealt with at some length, numerous species and varieties being described as new. A bibliography of four pages is included.

The blind louse of the honey-bee, W. Herrod-Hempsall (*Jour. Min. Agr. [Gt. Brit.], 37 (1931), No. 12, pp. 1176–1184, pls. 4*).—A report of studies of *Braula coeca*, which is very prevalent in Europe and South Africa.

An infection transmitted by ticks, W. R. Sanderson (*North Amer. Vet., 12 (1931), No. 5, pp. 20–22*).—This account refers to the transmission of relapsing fever by ticks identified as *Ornithodoros turicata*, contracted while visiting a

cave in Mills County, Tex. An account by Weller and Graham of this transmission has been noted (E. S. R., 65, p. 266).

ANIMAL PRODUCTION

The digestibility of bur clover as affected by exposure to sunlight and rain, F. R. GUILBERT and S. W. MEAD (*Hilgardia [California Sta.], 6 (1931), No. 1, pp. 1–12*).—Bur clover, cut while the burs were still green but with the seeds well formed, was divided into 3 lots on the basis of treatment received during curing. Bur clover No. 1 was cured for 1 day in a thin layer and then in cocks for 6 days. Bur clover No. 2 was exposed in a thin layer for 21 days, during which time it was wet twice by rain totaling 0.31 in. Bur clover No. 3 was cured in the same manner for 34 days and wet three times by rain totaling 0.78 in. The digestibility of each kind of hay was determined with sheep, using the method previously described (E. S. R., 58, p. 761).

The chemical composition of the respective lots of hay on the dry matter basis was as follows: Crude protein, 17.71, 17.35, and 17.86 per cent; nitrogen-free extract, 46.93, 46.27, and 44.84; ether extract, 3.34, 2.54, and 2.22; crude fiber, 22.97, 25.11, and 27.48; and total ash, 9.05, 8.72, and 7.61 per cent. The average coefficients of digestibility for the respective lots were for dry matter, 64.2, 59.18, and 55.68; crude protein, 74.11, 68.01, and 63.72; nitrogen-free extract, 70.91, 64.14, and 59.87; ether extract, 56.89, 40.85, and 23.64; and crude fiber, 51.51, 50.66, and 52.41.

The bur clover, even when cut in advanced stages of maturity, had a higher coefficient of digestibility than most hays. The decrease in digestibility with the grades of hay was due to the loss of soluble constituents caused by rain. The bleaching and leaching processes apparently decreased the palatability of the hay. The significance of the decrease in digestibility on gains in live weight is discussed.

The effect of leaching on the nutritive value of forage plants, H. R. GUILBERT, S. W. MEAD, and H. C. JACKSON (*Hilgardia [California Sta.], 6 (1931), No. 1, pp. 13–26*).—In an effort to determine the losses due to leaching, chemical analyses were made of leached and unleached samples of bur clover and oat hay and of the naturally cured range feeds soft chess (*Bromus hordeaceus*), stork's-bill alfileria (*Erodium botrys*), wild oats, and dry, bleached bur clover.

The greatest percentage loss due to leaching was of the constituents of the silica-free ash, that portion of the mineral in the plant available to animals. This loss varied from 25 to 67 per cent. Chlorine was lost in greatest amounts, the loss varying from 67 per cent in oat hay to as high as 86 per cent in bur clover. The percentage of calcium in bur clover and alfileria after leaching was not significantly different from the unleached samples, but the phosphorus was distinctly lower, particularly in bur clover leaves and stems. In the grass species a greater percentage of calcium was lost.

The amount of nitrogen-free extract lost varied from 6 per cent of the total in the case of soft chess to 35 per cent in bur clover leaves and stems. This loss represents largely the sugars which are easily digested and which also influence the palatability. The loss of crude protein varied from 1 per cent in the case of oat hay to 16 per cent in the case of bur clover and 18 per cent in soft chess. In general, the loss of protein from samples cut while green and cured was less than that of other constituents, while in the naturally cured samples there was a material reduction in the percentage of protein. Ether extract was influenced only slightly by leaching. Crude fiber was not leached out and increased in percentage from 3 to 6, while losses of from 10 to 20 per cent of total solids were occurring. The increase in fiber content may have a depressing effect on the

digestibility of the other constituents in addition to being itself difficult to digest.

This work was carried on in cooperation with the U. S. D. A. Bureau of Animal Industry.

Wheat as a substitute for corn in animal feeding (*R. I. State Col. Ext. Bul. 55* (*1930*), *pp. 11*).—The value of wheat as a feed for livestock and its use in rations for various classes of livestock are discussed in this publication by J. E. Ladd. C. P. Hart describes the use of wheat in rations for poultry.

Commercial feeding stuffs, H. R. KRAYBILL ET AL. (*Indiana Sta. Circ. 181* (*1931*), *pp. 39, fig. 1*).—A report of 2,840 samples of commercial feeding stuffs collected during the year 1930 and subjected either to microscopic examination or to chemical analysis. The results of the inspection showed that 80 per cent of the samples were equal to or better than the manufacturer's guaranty and that 335 samples were seriously deficient (E. S. R., 63, p. 556).

Fattening calves and yearlings, E. L. POTTER, R. WITHYCOMBE, and F. M. EDWARDS (*Oregon Sta. Bul. 276* (*1931*), *pp. 18, figs. 2*).—The calves from the cows referred to in a previous bulletin (E. S. R., 64, p. 863) were available in numbers ranging from 36 to 71 per year for 4 years. The larger calves each year were divided into lots of 9 and 10 each and were fed in various ways for the April and May market, which meant that they were marketed at about 12 months of age. The remaining calves were fed through the winter, pastured the following summer, and fed out experimentally the second winter, being marketed as they approached 24 months of age. The more important comparisons were repeated two and three times.

While some differences were noticed in the feeding value of rolled wheat, cracked corn, and a grain mixture composed of barley, mill-run, and oats 3:1:1, and rolled barley for fattening calves and yearlings, the selection of the grain should be based upon economy. Substituting linseed meal for part of the barley ration increased the cost without materially changing the results. Adding 10 lbs. of peas and barley silage decreased the hay consumption 3.8 lbs., but did not increase the gains. Chopping the hay decreased the waste and increased the gains without increasing the hay consumption.

The steer calves gained 5 per cent faster than the heifer calves, but were not so fat at the end of the feeding period. At 12 months of age heifers sold for the same price as steers of the same age and fed in the same manner, but at from 20 to 23 months of age heifers sold at a lower price than steers. For producing baby beef, calves should be large, well grown, and should be weaned without loss of weight or condition. While calves made good gains, the degree of finish they attained was not as dependable as that of more mature animals.

Returns per acre in cattle feeding, Part III, P. GERLAUGH and H. W. ROGERS (*Ohio Sta. Bimo. Bul. 151* (*1931*), *pp. 132–134, fig. 1*).—Continuing this study (E. S. R., 63, p. 858), 2 lots of 12 steers each, averaging approximately 784 lbs. per head, were fed for 165 days on a basal ration of corn silage and first-year sweetclover hay. In additon lot 1 received 2 lbs. of cottonseed meal per head daily and lot 2 a like amount of shelled corn. The average daily gains in the respective lots were 2.47 and 2.06 lbs. per head.

Lot 1 returned 541 lbs. of beef and 19 lbs. of pork and lot 2, 496 lbs. of beef and 28 lbs. of pork per acre of corn fed. The return per acre of corn, including the pork produced, was $22.15 in lot 1 and $16.50 in lot 2. The steers in lot 1 dressed 58.7 per cent and those in lot 2, 57 per cent. The carcasses in both lots were satisfactory in color and firmness.

Returns per acre in cattle feeding, P. GERLAUGH and H. W. ROGERS (*Ohio Sta. Bimo. Bul. 151* (*1931*), *pp. 135–139*).—A summary of three years' work, the last of which is noted above.

International live stock atlas.—I, International cattle atlas: Germany, Hungary, Netherlands, Switzerland (*Atlas International Zootechnique.—I, Atlas International des Bovins: Allemagne, Hongrie, Pays-Bas, Suisse. Rome: Inst. Internatl. Agr., 1930, vol. 1, [pts. 1–4], pp. 63, figs. 21; pp. 56, pl. 1, figs. 11; pp. 45, pl. 1, figs. 14; pp. 49, pl. 1, figs. 12*).—The breeds of cattle of Germany, Hungary, Netherlands, and Switzerland, their uses, breeding conditions in these countries, and methods of promoting the breeds are described in this atlas. Maps are included which show this distribution of the breeds, as well as the density of stocking in the various countries and continents. The text is in French and German as well as in the language of the country dealt with.

Sheep production in California, R. F. Miller (*Calif. Agr. Col. Ext. Circ. 49 (1930), pp. 66, figs. 27*).—This publication includes a brief statistical review; a discussion of the most prominent breeds; practical suggestions in the feeding, care, and management of sheep; and a brief discussion concerning some common parasites.

Corn, wheat, and rye for fattening lambs, M. L. Baker (*Nebraska Sta. Bul. 256 (1931), pp. 7, fig. 1*).—In this study 5 lots of 50 white-faced Wyoming lambs each, averaging 62 lbs. initial weight, were fed for 115 days on a basal ration of alfalfa hay. In addition the respective lots received shelled corn, whole wheat, whole rye, equal parts of shelled corn and whole wheat, and equal parts of shelled corn and whole rye. The average daily gains in the respective lots were 0.25, 0.23, 0.24, 0.25, and 0.24 lb. per head. The death losses that occurred during the test were not attributed to the feed received. The dressing percentages were approximately equal in all lots except the rye-fed lot, which was from 1 to 1.5 per cent lower in this respect than the other lots. The carcass grades showed a slight advantage in favor of the lambs receiving corn alone, and there were fewer medium and cull carcasses in the lots receiving rye than in the lots receiving wheat. Both wheat and rye were fully as palatable as corn, although the lambs showed a slight preference for rye as compared with wheat. Wheat alone was the least satisfactory ration tested.

In a second test 2 lots of 25 high-grade native Rambouillet lambs each were fed for 84 days on alfalfa hay and either shelled corn or equal parts of shelled corn and whole rye. The lambs averaged 66 lbs. initial weight and made an average daily gain of 0.3 and 0.32 lb. per head in the respective lots. The lambs ate the rye readily. There was no apparent difference in the quality or finish of the 2 lots at the end of the test.

Wheat for fattening lambs, A. D. Weber and W. J. Loeffel (*Nebraska Sta. Bul. 257 (1931), pp. 16, figs. 4*).—This study was undertaken to compare shelled corn and whole wheat, to determine whether or not wheat should be ground for lambs, and to ascertain the advisability of feeding a mixture of wheat and corn. Two tests of 84 days each were conducted, using black-faced Idaho lambs averaging 67 lbs. initial weight in the first test and white-faced Wyoming lambs averaging 62 lbs. in the second test. In the first test, two lots of 24 lambs and one lot of 23 lambs were fed alfalfa hay, and in addition the respective lots received shelled corn, whole wheat, and ground wheat. In the second test, six lots of 30 lambs and one lot of 29 lambs were fed alfalfa hay, to which was added in the respective lots shelled corn, ground corn, whole wheat, ground wheat, equal parts of shelled corn and whole wheat, equal parts of ground corn and ground wheat, and 1 part of ground corn and 3 parts of ground wheat. The average daily gains in the respective lots were 0.33, 0.28, and 0.25 lb. per head in test 1, 0.3, 0.29, 0.27, 0.28, 0.28, 0.3, and 0.31 lb. per head in test 2.

Whole wheat was found to be practically as palatable for fattening lambs as shelled corn, but in test 1 it was only 85 per cent and in test 2, 88 per cent as efficient as shelled corn for producing gains. When ground wheat was fed alone it was distinctly less palatable than whole wheat or shelled corn, but was more efficient for producing gains than whole wheat. It was found profitable to grind wheat when the cost of grinding 100 lbs. did not exceed the value of 6.8 lbs. of wheat and 8.4 lbs. of alfalfa hay. The grain mixture made up of 3 parts of ground wheat and 1 part of ground corn produced as rapid and as economical gains as shelled corn. This mixture was more profitable than shelled corn when 75 lbs. of wheat was enough cheaper than a like amount of corn to pay for grinding 100 lbs. of the mixture.

A study of three average corn-fed and three average whole wheat-fed lambs showed little difference in dressing yields, carcass quality, or palatability.

Hand-feeding v. self-feeding fattening lambs, D. S. Bell (*Ohio Sta. Bimo. Bul. 151 (1931), pp. 139–144*).—This is a more detailed account of work previously noted (E. S. R., 64, p. 660).

Rations for fattening hogs on soybean forage, E. G. Godbey (*South Carolina Sta. Bul. 274 (1931), pp. 15, figs. 2*).—Concluding these studies (E. S. R., 64, p. 663), it was found that a 2.5 per cent ration of corn or corn and tankage produced cheaper gains on soybean forage than full feeding these rations. Adding tankage to the limited ration increased the gains and profits, and when added to the full-fed ration tankage increased the gains but decreased the profits. Feeding either the limited or full-fed rations on soybean forage produced more economical gains than full feeding corn and tankage in dry lot.

Of the hogs finished on mature soybeans and a full feed of corn, approximately three-fourths had soft or oily carcasses, while about one-half of the hogs full fed corn and tankage on mature soybeans killed soft or oily. The dockage on the above rations was $1.50 and $1 per 100 lbs., respectively. Pigs receiving a limited ration on soybean forage were docked $2 per 100 lbs. On the basis of gains and value of carcass full feeding corn and tankage on soybean forage was the most profitable method and full feeding corn and tankage in dry lot the next most profitable method of finishing hogs in these tests.

Two experiments on tapioca meal as food for pigs, G. W. Howie (*Jour. Min. Agr. [Gt. Brit.], 37 (1930), No. 9, pp. 885–890*).—In two tests at the experimental farm of the Board of Agriculture for the Isle of Man, high-grade tapioca root flour was used to replace about 25 per cent of the maize meal in a ration for fattening pigs. In one test the pigs receiving tapioca meal made an average daily gain of 1.36 lbs. per head and in the second test 1.27 lbs. The gains for the pigs receiving maize meal in the respective tests were 1.35 and 1.19 lbs. per head daily. The tapioca meal was quite palatable and had no injurious effects upon the digestive system or the quality of the carcass.

Dried buttermilk for growing and fattening pigs, J. M. Evvard, C. C. Culbertson, and Q. W. Wallace (*Iowa Sta. Bul. 278 (1931), pp. 117–148, figs. 12*).—The object of this study was to determine the comparative value and efficiency of meat meal tankage, dried buttermilk, and various combinations of these feeds on health, gains, feed requirements, water consumption, time required to reach 225 lbs. in weight, and other factors, when these protein feeds were self-fed with shelled corn to pigs in dry lot. Pigs averaging about 50 lbs. were divided into 12 lots of 2 pigs each. The lots were fed in such a manner that the ration of any one group varied from the preceding group by the substitution of 10 lbs. of dried buttermilk for an equal quantity of tankage per 100 lbs. of supplement fed. Block salt was fed to all lots.

Adding dried buttermilk to the basal ration of shelled corn, tankage, and salt increased the rate of gain and decreased the feed required per unit of gain

when the proportion of dried buttermilk as compared with tankage in the combined supplement was fairly high. Dried buttermilk also brought about a physiological improvement in the ration. With one exception the lots receiving dried buttermilk required less total protein per unit of gain than did the lot receiving tankage only. The straight buttermilk proteins were better corn supplements than the straight tankage proteins. The lots receiving buttermilk consumed more water daily and required more water per 100 lbs. of gain than did the check lot.

It was found in this test that 100 lbs. of dried buttermilk was approximately equal in relative feeding value to about 75 or 80 lbs. of tankage from the standpoint of gains produced. On the average, 100 lbs. of dried buttermilk replaced 75 lbs. of tankage and 7 lbs. of corn in producing gains. It is concluded that while the dried buttermilk is an efficient supplemental feed, its relatively high price has to be taken into account and its relative economy as compared with other protein feeds considered in using this feed for swine.

Pig breeders' annual, 1931–1932 (*London: Natl. Pig Breeders' Assoc., 1931–1932, pp. 23–139, figs. 47*).—The following articles are included: The Judging of Live Stock in Relation to Commercial Requirements, by H. R. Davidson (pp. 23–32); A Survey of the Prices of Pigs and Feeding-stuffs in England and Wales during 1930, by K. A. H. Murray (pp. 33–40); The Standards of Excellence of Our Pure Breeds, by W. H. Forshaw (pp. 40–47); The Work of the Harper Adams Pig Feeding Experimental Station during 1930, by C. Crowther (pp. 47–57); Dentition of Pigs as an Indication of Age—Interim Report, by B. de Vine and H. W. Dawes (pp. 58–68); The Canadian Pig Industry and Some Lessons for the "Old Country," by A. N. Duckham (pp. 68–79); Problems in Breeding for High Prolificacy, by I. Johansson (pp. 80–87); Summary of Work at Wye College, 1930, by V. C. Fishwick (pp. 88, 89); Pigs and Forage Crops, by A. G. Ruston and H. E. Nichols (pp. 90–97); How Pigs Are Judged in Sweden, by M. de Wachenfelt (pp. 98–105); Pig-breeding and Feeding in Practice, by R. Atkinson (pp. 105–115); Cost Relationships in Bacon and Pork Production, by A. W. M. Kitchin (pp. 116–120); Pig Breeding in the Irish Free State, by J. Lucey (pp. 121–125); Agricultural Shows in Australia, by E. J. Shelton (pp. 125–129); Results Obtained by Feeding Small Quantities of Cows' Milk to Porkers, by J. Golding and A. Blissett (pp. 130–133); Cramp and Lameness in Pigs, by C. G. Saunders (pp. 133–137); and Pig Production in South Africa, by A. A. Persse (pp. 137–139).

Feeding hens for egg production, E. W. Henderson and C. W. Knox (*Iowa Sta. Circ. 129 (1931), pp. 12, figs. 4*).—A popular publication indicating the feeding practices and rations that will give efficient and economical egg production under Iowa conditions.

Feeding for egg production, F. E. Fox (*Oreg. Agr. Col. Ext. Bul. 433 (1931), pp. 8, figs. 2*).—The principles and practices of feeding for egg production are described in this publication.

Chick brooding, F. E. Fox (*Oreg. Agr. Col. Ext. Bul. 435 (1931), pp. 12, figs. 5*).—The details of brooding baby chicks, types of brooders, and systems of brooding, together with methods of feeding and successful rations, are discussed.

Chick management, R. B. Thompson (*Okla. Agr. Col. Ext. Circ. 268 (1930), pp. 16, pl. 1, figs. 3*).—The care, management, and feeding of chicks from the incubator to the pullet and cockerel stage are described in this publication.

Crooked breasts in turkeys, K. W. Niemann (*Nevada Sta. Bul. 122 (1931), pp. 22, figs. 3*).—In this study 50,613 turkeys were examined for crooked breast bones at the receiving docks of the Nevada Turkey Growers' Association. Of this number 1,662, or 3.28 per cent, were found to have crooked breasts.

The second portion of the study consisted of an examination of conditions and production methods on the ranches where the above birds were raised. Information was obtained at 307 ranches relating to breeding stock, incubation and egg selection, brooding, housing poults, range, feeding, roosts, sanitation, and disease losses.

Based on the above observations it is concluded that economic losses from crooked breasts in the State are not serious, amounting to less than 1 per cent loss on the total sales value. The results of the study and a review of the literature indicated that there is no definite specific cause of crooked breasts in turkeys. Recommendations are made for reducing the occurrence of crooked breasts to a negligible minimum.

Rabbits for food and fur, F. G. ASHBROOK (*New York: Orange Judd Pub. Co., 1930, pp. 176, pls. 36, figs. 8*).—This treatise was designed to include the more important phases of rabbit production for meat and fur. The breeding, feeding, management, sanitation, and preparation of meat and fur for marketing are described.

DAIRY FARMING—DAIRYING

An interpretation of the feeding standards for growing dairy cattle, J. B. FITCH and R. H. LUSH (*Jour. Dairy Sci., 14 (1931), No. 2, pp. 116–124, figs. 4*).—In this paper from the Kansas Experiment Station, the Armsby and Morrison feeding standards are compared as to their requirements. The authors conclude that, while any feeding standard should be used only as a guide, the Morrison standard for growing dairy animals lends itself readily to the majority of experimental trials. To facilitate the interpretation of the standard, charts are presented from which the requirements for proteins and total nutrients according to the age of the animal are easily obtained.

A preliminary study of the determination of the apparent digestibility of protein by modified procedures, W. D. GALLUP and A. H. KUHLMAN (*Jour. Agr. Research [U. S.], 42 (1931), No. 10, pp. 665–669*).—In this study at the Oklahoma Experiment Station a 10-day digestibility trial was conducted with 4 Jersey heifers, averaging about 500 lbs. per head. The apparent digestibility of the protein of choice cottonseed meal and of autoclaved cottonseed meal was calculated from a determination of the ratio of the amount of protein to both iron and silica in the feed and in the feces. An average value of 71.9 per cent was obtained for the digestibility of cottonseed meal protein.

In this work it was found that the silica naturally present in the feed was a better index of the digestibility of the other substances than the iron which was added for that purpose.

Calculating rations for dairy cows, T. E. WOODWARD (*Jour. Dairy Sci., 14 (1931), No. 2, pp. 173–176*).—A rapid system of calculating rations when the weight of the cow and the quantity and quality of the milk produced are known is described in this article from the U. S. D. A. Bureau of Dairy Industry. This system is based on the Savage standard, but a similar method can be used for any standard desired.

The effect of feeding menhaden (fish) oil on the secretion of milk and the composition of butter fat in the dairy cow, J. B. BROWN and T. S. SUTTON (*Jour. Dairy Sci., 14 (1931), No. 2, pp. 125–135, figs. 4*).—In this study feeding menhaden oil to a dairy cow for 14 days decreased the average daily milk production from a 17–18-lb. level during the 6-day preliminary period to a 10.4-lb. level during the period when fish oil was fed. The recovery in production after the oil was discontinued was slow, and there was a permanent drying-off effect due to feeding the oil. The percentage of butterfat dropped

from 3 to 2.1, but in this case complete recovery occurred in about 2 weeks after the oil was discontinued. The characteristic highly unsaturated acids of the menhaden oil passed into the butterfat in small amounts. The analytical constants of the butter were found to change to those of a mixture of butter with menhaden oil.

Several specimens of normal butter were found to contain small quantities (0.3 per cent) of a highly unsaturated fatty acid similar to arachidonic acid, a constituent of menhaden oil.

Dry cotton discs are most efficient milk strainers, G. M. Trout (*Michigan Sta. Quart. Bul., 13 (1931), No. 4, pp. 215–218, figs. 2*).—In an effort to determine the comparative values of several types of strainer materials for removing sediment from milk, eight different kinds of strainer cloth materials and cotton pads were studied. The materials tested consisted of two different makes of common cotton disks, one gauze-face reinforced cotton disk, squares of flannel, percale, doubled cheesecloth, muslin with fiber side up, and muslin with fiber side down. The efficiency of each type of strainer was determined by pouring 3 gal. of whole raw milk to which was added 5 gm. of finely pulverized dirt through each strainer at temperatures of 95, 80, and 60° F. In one series of tests all the strainers were wet with water before admitting the milk, while in another series the strainers were dry.

At 95° the milk passed through the strainers very rapidly whether wet or dry, while at 80° the time required for milk to pass through strainers previously wet was considerably longer than when the strainers were dry. The flow of milk at 60° was too slow to be practical. The period required for the milk to pass through the strainer depended upon the thickness and nature of the material. Of the various cloths used, flannel was most efficient in removing sediment from milk. However, the flannel was not as efficient as the three types of cotton pads used, which were very efficient and rapid when not more than from 10 to 15 gal. was strained through the same pad.

In a second series of tests 40 gal. of milk was strained through each of the three cotton strainer disks and through flannel at 95°. The flow of milk was considerably decreased after the first 10 gal. had passed through the strainer, and it was often necessary to give the strainer a slight jar at the beginning or soon after the second 10 gal. of milk was introduced. In every case jarring was unsatisfactory for it appeared to make small holes in the strainer pad, which resulted in uneven straining, and the previously collected dirt passed readily through these holes.

The production of high quality milk.—III, Electric cooling versus ice cooling, J. A. Newlander (*Vermont Sta. Bul. 326 (1931), pp. 14, figs. 4*).—Continuing this series of studies (E. S. R., 65, p. 564), a comparison was made of dry-storage and wet-storage type coolers and of ice for cooling milk.

It was found that milk in 40-qt. cans immersed in water at 32° F. and not stirred required 1.25 hours to cool from 90 to 50°, and that the most rapid decrease in temperature occurred during the first 15 minutes. When ice and warm milk were simultaneously placed in water at 70° it required 3.5 hours to cool the milk to 50°. Cooling with air at a temperature of from 3 to 12° required from 5.5 to 6 hours to lower the temperature of milk to 50°, and snow-bank cooling was likewise a slow process.

When the wet-storage type cooler was used, only 63 per cent as much electrical energy was required as with the dry-storage type. On the average it cost 15 cts. per 100 lbs. to cool the milk using the wet-storage type mechanical cooler and 14.5 cts. using ice. Over a period of a year the average cost of mechanical refrigeration (wet-storage type) was 12.75 cts. per 100 lbs. of milk.

Approximately 1 kw. hour of electricity or from 35 to 40 lbs. of ice were needed to cool 100 lbs. of milk.

Agglutinin, complement, and chemical composition of the colostrum of the cow, M. Sato, K. Ogura, and H. Ikejima (*Jour. Dairy Sci., 14 (1931), No. 2, pp. 156–172*).—In a study at the Hokkaido Imperial University, Japan, it was shown that following normal parturition the colostrum of the cow always contained agglutinins for a period of from 1 to 4 days. These agglutinins as a rule speedily decreased in number after parturition and finally disappeared. Usually the agglutinins reacting with *Bacterium coli* and *Vibrio fetus* were more numerous, and those reacting with *B. paratyphosum* B, *Bacillus melitensis*, and *B. abortus* ranked next in the order named.

The breed of cattle and number of parturitions apparently had no influence on the quantity of agglutinins or the length of time they remained in the colostrum. There appeared to be no fixed rules for the appearance of agglutinins in the colostrum of cows suffering from inflammation of the udder, and their presence could not be proved in the milk secreted by a cow which aborted in the fourth month. On the other hand, a large quantity of agglutinins was found in milk secreted 19 hours before parturition. The presence of complements was not found in fresh normal colostrum.

Chemical analyses of colostrum from the same and different cows showed that the specific gravity and total ash remained fairly constant, but there were wide variations in the H-ion concentration, color, coagulation, percentage of total proteins and relative proportions of each, percentage of lactose, and fat content.

The effect of dilution on the titratable acidity of cows' milk, H. H. Sommer and J. Ménos (*Jour. Dairy Sci., 14 (1931), No. 2, pp. 136–155, figs. 2*).—At the Wisconsin Experiment Station the titratable acidities of a number of samples of fresh milk were compared with the acidities found in the same samples after dilution with 1 volume and 9 volumes of distilled water.

It was found that dilution with an equal volume of water caused an average decrease of 0.0211 per cent and dilution with 9 volumes of water an average decrease of 0.0623 per cent in the titratable acidity. The greater part of the dilution effect was attributed to a decrease in the amount of tricalcium phosphate precipitated during titration. There were indications of a relationship between calcium and casein, similar to that of calcium and phosphate, in the dilution effect.

A lower pH value was observed at the phenolphthalein end point in the titration of diluted milk. The rapid fading of the end point was attributed to the precipitation of tricalcium phosphate. The fact that the tritatable acidity of concentrated milk is higher than that calculated from the acidity of the original milk and the ratio of concentration was attributed to the reverse of the same factors involved in the dilution effect. Neutralizing milk or cream with lime of known alkalinity did not lower the acidity to the calculated point because the increased calcium-ion concentration caused greater precipitation of tricalcium phosphate in subsequent titration.

A test for the detection of milk unstable to heat, G. A. Ramsdell, W. T. Johnson, Jr., and F. R. Evans (*Jour. Dairy Sci., 14 (1931), No. 2, pp. 93–106, figs. 3*).—In this paper from the U. S. D. A. Bureau of Dairy Industry, a test is described which gives an accurate and rapid means for the detection of milk unstable to heat. The test consisted of placing 2-cc. samples of milk in Pyrex test tubes of approximately 20 cc. capacity and adding 0.2 cc. of a phosphate solution, made by dissolving 68.1 gm. of monobasic potassium phosphate in water and diluting the solution to 1 liter. The contents of the tubes were then

mixed and the tubes immersed in boiling water for 5 minutes. They were then removed, cooled, and the mix examined for curd, the presence of which indicated that the concentrated product was of low heat stability.

Extensive tests showed that milk which coagulated in the above test was invariably of low heat resistance, and that composites of this class of milk were also of low heat stability. Grading milk on the basis of this test often resulted in obtaining a milk of higher heat stability. However, this was not always the case and depended upon the proportion of such milk used.

This article defines the phosphate number, shows the relationship between the phosphate number and coagulating time, and also shows that there is apparently no relationship between pH concentration and phosphate number. Single herds of cattle were found to be reasonably constant in their phosphate number.

Ohio tests prove natural milk is best, E. Scott and L. A. Erf (*Jersey Bul. and Dairy World, 50 (1931), No. 6, pp. 210, 211, 224–226, 237, figs. 7*).—In a series of tests, each of which covered a 5-months period, a total of 147 rats were fed either certified milk, special milk from cows receiving a ration high in minerals and vitamins, special milk pasteurized, or commercial pasteurized milk. A control group fed a grain diet and allowed a considerable quantity of green feed was included.

The average initial weight in the control group was 40 gm., and in the respective milk groups was 42, 46, 45, and 46 gm. per head. At the end of the 5-months period the average weights in the respective lots were 210, 185, 168, 147, and 99 gm. per head. The average initial red cell counts in the respective groups (expressed in millions) were 6,7; 6,2; 6,1; 6,1; and 6,5; while at the end of the test they were 10,2; 10,1; 8,1; 6,2; and 5,8.

These results show that the milk of cows fed a diet rich in minerals and vitamins was more nutritious than the usual commercial milk. The milk from properly fed cows when heated as in pasteurizing loses some of its hematogenic and growth-promoting properties. Fortifying the pasteurized milk with cod-liver oil and tomato juice did not make it equal to the special milk for promoting growth and development in rats. The special raw milk did not produce the anemia which usually occurs when rats are fed an exclusive milk diet.

Influence of air upon cream deterioration, E. H. Parfitt and M. L. Galema (*Natl. Butter Jour., 22 (1931), No. 6, pp. 13, 14, 40*).—At the Indiana Experiment Station samples of cream were divided into two parts, one of which was placed in a half-pint glass-top Mason jar, filled within 0.25 in. of the top, and sealed by means of a rubber gasket and clamp. The other part was placed in a similar jar, filled to the same level, and covered but not sealed. At periodic intervals tests were made to determine the effect of the exclusion of air on the rate of growth of bacteria, yeasts, and molds, the amount of protein decomposition, and the changes in acidity and flavor.

The results of these analyses show that there is less growth of bacteria, yeasts, and molds in the cream held in the air-tight containers. The cream from which the air was excluded showed less protein decomposition and slightly greater acid development than the control cream. Cream had a more desirable flavor, as did also the butter made from it, when it was held in an air-tight container.

Variations in the component fatty acids of butter due to changes in seasonal and feeding conditions, T. P. Hilditch and J. J. Sleightholme (*Biochem. Jour., 24 (1930), No. 4, pp. 1098–1113*).—In a study at the University of Liverpool, England, detailed analyses were made of the fatty acids of four samples of English butterfats obtained from the same herd of cows at different

seasons of the year, and some of these samples were obtained from animals on various rations.

The results of the analyses showed that the ingestion of added fat in the ration in the form of coconut cake or soybean cake had a definite though minor effect on the fatty acids present in butterfat. The fatty acid composition was more largely influenced by such factors as the change from pasture to barn feeding, the character of the ration, and the seasonal changes in temperature. The differences associated with the above factors were chiefly in the variations in the amount of unsaturated acids present and in the amounts of such lower saturated acids as butyric and lauric acids. Palmitic acid appeared to be the most constant in its proportions, while the stearic acid content varied erratically from one butterfat to another.

These analyses were characterized by the amounts of butyric and myristic acids which were more or less specific for the milk fat of cows and by the amounts of palmitic, oleic, and linoleic acids, which, while equally characteristic of most butterfat, were also not greatly unlike the proportions of the same acids found in the body fats of the same class of animals.

Bacteriology of butter.—II, A method for the microscopic examination of butter, B. W. Hammer and J. A. Nelson (*Iowa Sta. Research Bul. 137 (1931), pp. 105–120, figs. 7*).—In this study (E. S. R., 65, p. 67) the following method has been found satisfactory for the microscopic examination of butter:

The representative sample of butter is melted by heating to 45° C., and 10 cc. of the melted butter is centrifuged in a separatory funnel until the serum is separated from the fat. The serum is then drawn off and 0.01 cc. of the thoroughly mixed serum measured with a Breed pipette over a definite area on a microscopic slide and allowed to dry. The slide is then stained as in the microscopic count for milk and examined for the general character of the flora. When an estimation of the number of organisms per cubic centimeter of butter is desired, the number per microscopic field of serum is determined and then calculated to the number per cubic centimeter of serum and finally the number per cubic centimeter of butter.

The detailed steps in the suggested method are described.

The manufacture of cottage cheese in Iowa creameries and milk plants, E. F. Goss and G. Mutten (*Iowa Sta. Circ. 126 (1931), pp. 16, figs. 11*).—The various steps in the manufacture of cottage cheese, packaging and marketing the product, the cost of manufacture, and the margin of profit that may be expected are described in this publication.

The effect of pasteurizing and homogenizing temperature on certain properties of ice cream mixes, C. D. Dahle and G. S. Barnhart (*Jour. Agr. Research* [*U. S.*], *42 (1931), No. 10, pp. 675–688, figs. 4*).—Concluding this study (E. S. R., 64, p. 171) at the Pennsylvania Experiment Station, it was found that processing ice cream mixes at 170 and 180° F. decreased the degree of fat clumping, reduced viscosity and freezing time, and increased protein stability. The difference obtained between 170 and 180° was not sufficient to warrant using temperatures much in excess of 170°. Pasteurizing and homogenizing at the high temperatures gave the greatest benefits, while lowering the temperature to 150° for homogenizing offset some of the benefits obtained, especially when lowered from 180°. The continuous system of heating was found to be the simplest method for obtaining the high temperatures. Pasteurizing at the high temperatures had a greater effect on viscosity, overrun, and protein stability, while homogenizing had a greater effect on fat clumping.

Speed of dasher and scraper as affecting the quality of ice cream and sherbet, E. L. Reichart (*Jour. Dairy Sci., 14 (1931), No. 2, pp. 107–115*).—At the Nebraska Experiment Station a series of four trials was conducted to

determine the effect of the speed of the dasher and scraper of an ice cream freezer upon the quality of ice cream and sherbet. The dasher was arranged so that it could be run at high speed, 260 r. p. m., medium speed (normal) 200 r. p. m., and low speed, 163 r. p. m. In two of the trials the scraper was operated above the normal speed of 295 r. p. m.

The results showed that the speed at which the dasher was operated had no appreciable effect on the rapidity of freezing ice cream, upon the time for incorporating 100 per cent overrun, or upon the body and texture of the finished ice cream. With sherbets, where an overrun in excess of from 30 to 40 per cent is undesirable, the reduction of the effect of the dasher by slowing down its speed, by allowing it to idle, or by operating it at normal speed in the same direction as the scraper was useful in preventing too rapid incorporation of overrun and the consequent necessity of drawing the sherbet before it was properly frozen.

Operating the scraper at slightly above normal speed shortened the freezing time and the time necessary to obtain 100 per cent overrun and also tended to produce a slightly smoother body. Of the two factors studied, the speed of the scraper was the more important.

VETERINARY MEDICINE

The fitweed (Capnoides caseana): A poisonous range plant of the northern Sierra Nevada Mountains, C. E. Fleming, M. R. Miller, and L. R. Vawter (*Nevada Sta. Bul. 121 (1931), pp. 29, figs. 11*).—The first or main part of this bulletin consists of a practical summary of information, including reports of feeding tests with sheep and cattle. The second or technical section contains a discussion of dosage and symptoms of poisoning, by Vawter (pp. 23–25), and an account of the alkaloidal content of *C. caseana*, by Miller (pp. 26–28).

This plant is found in the higher parts of the northern Sierra Nevada in the shaded mountain canyons. Growing in localities where the willows and quaking aspens and other trees form excellent shade during the hot portion of the day for sheep and cattle, it is relished by both but is dangerously poisonous. There is said to be every reason to believe that this weed has already caused the death of many hundreds of sheep on the ranges where it grows. The sheep poisoned by it may die within a few hours or may linger for a day or more before death. The first symptoms of poisoning in sheep are dullness and heaviness. Poisoned animals breathe more and more rapidly at first, the heart action is quickened, the animal loses all sense of direction, staggers, and falls to the ground in convulsions. It bites almost incessantly at objects on the ground, chewing at sticks and dirt or any other object within range. The convulsions become more severe and the animal grows weaker. Breathing and heart action grow slower until the animal finally collapses and dies. The symptoms shown by all of the sheep and by one steer were quite similar in each instance. Poisoning is due to the fact that the fitweed contains one or more deadly alkaloids, substances that belong in the same group of chemical compounds as strychnine, nicotine, and other well-known poisons. Some symptoms were observed in sheep that were fed as little as 1.5 lbs. of the green plant. Somewhat larger quantities caused symptoms of poisoning, but the sheep recovered. Quantities ranging between 5 and 6.25 lbs. caused death.

While there is no remedy for the fitweed poisoning, it may be prevented by keeping sheep off the ranges on which the plant grows, or by destruction of the plant before pasturing. The authors consider it probable that rooting out and destroying the fitweed from the range at relatively small expense will be found practicable.

The toxicity of sodium fluosilicate for domestic animals, J. D'Costa and B. Singh (*Jour. Cent. Bur. Anim. Husb. and Dairying, India, 4 (1930), No. 4, pp. 139–145*).—In the experiments reported no toxic symptoms were observed in the 2 buffaloes, 6 bulls, 3 sheep, and 3 goats that grazed over a plat of land that had been treated with sodium fluosilicate at the rate at which it would be used for the destruction of locusts, namely, 1 lb. per acre. "Five bulls were each fed with 5 to 25 grains of sodium fluosilicate mixed with bran mash and molasses, but none of these developed toxic symptoms. A bull drenched with 0.5 dr. of sodium fluosilicate showed symptoms of depression and slight alimentary disturbance. Another bull drenched with 0.5 oz. of the same drug developed severe symptoms of poisoning. Three months later when destroyed both bulls showed evidence of the toxicity of the drug in the abomasum and duodenum. At the close of the observations all the animals were in perfect health and showed a remarkable increase in their body weight."

Variation of phenol coefficients of coal-tar disinfectants with different test organisms, B. G. Philbrick (*Indus. and Engin. Chem., 22 (1930), No. 6, pp. 618, 619*).—The author reports upon a study made of a series of coal-tar disinfectants representing the four strengths, or *Bacillus typhosus* phenol coefficient values, most generally offered in the market.

The results reported are said to make it possible, if the *B. typhosus* phenol coefficient is known, to ascertain the approximate efficiency of the disinfectant against *Staphylococcus aureus, B. diphtheriae, Streptococcus hemolyticus,* and Pneumococcus in either the presence or absence of organic matter. "This relative efficiency against these organisms can be found in terms of phenol coefficiency or in terms of the maximum dilution of the disinfectant which will kill the given organism in five minutes' exposure in the presence of organic matter. Further, from that portion of the study dealing with *B. tuberculosis,* it is possible, knowing the *B. typhosus* phenol coefficient of the coal-tar disinfectant, to ascertain the proper dilution of disinfectant necessary to render tubercular sputum sterile in an exposure period of one hour."

Limitations of phenol coefficients of coal-tar disinfectants, C. M. Brewer and G. L. A. Ruehle (*Indus. and Engin. Chem., 23 (1931), No. 2, pp. 150–152*).—The authors find that at present sufficient work has not been done to determine a criterion of resistance for the great bulk of the pathogenic bacteria. In the work reported the authors used the coal-tar disinfectants and compared the *Bacillus typhosus* and *Staphylococcus aureus* phenol coefficients, the effects of coal-tar disinfectants giving milky solutions being reported in detail, and those of cresol compounds and compounds forming clear solutions in tabular form.

"From these figures we may conclude that it is impossible to calculate the *S. aureus* phenol coefficient from the *B. typhosus* coefficient, at least in the case of coal-tar phenol disinfectants, and that the phenol coefficient is limited in usefulness to interpretations based on comparisons of different disinfectants against the test organisms alone and only under the prescribed conditions of the tests."

BCG vaccine—a review of its uses, S. R. Gloyne (*Bul. Hyg., 6 (1931), No. 1, pp. 1–5; also in Vet. Bul., 1 (1931), No. 1, pp. 16–20*).—This is a digest of the literature on the use of B. C. G. vaccine.

Bacterium abortus (Bang) isolated from a gelatinous infiltration formed in the uterus of a cow, A. H. Harms (*Jour. Amer. Vet. Med. Assoc., 78 (1931), No. 5, pp. 713, 714*).—This is a report of observations made at the Kentucky Experiment Station of an unusual specimen, namely, a gelatinous infiltration brought in with the placenta of an aborting cow. "Two of the plates from the gelatinous material contained a great number of colonies of *B. abortus* (Bang)

in pure culture. Another plate was nearly covered with *B. abortus* as is noted in streak dilutions of pure culture of the organism. Stained smears of this infiltration showed the Bang organism present in large numbers. Several small colonies of *B. abortus* (Bang) developed on the plates streaked with small bits of the placenta. The blood serum of this cow responded positively to the agglutination test." A similar case is said to have been observed by the attending veterinarian about a year previously when another cow in the same herd delivered a premature calf.

Control and eradication of Bang's abortion disease, D. E. Madsen and W. H. Hendricks (*Utah Sta. Circ. 94 (1931), pp. 8, figs. 2*).—The seriousness of abortion disease in Utah having made it necessary to promote more definite plans toward its control and eradication in that State, three different methods of procedure are outlined. It is pointed out that the laboratory of animal pathology of the station will cooperate with the State sanitary officials and with local veterinarians in supervising the control plans, and that in order to take advantage of this cooperative supervision the herd owner will be asked to conform to a certain form of procedure. A form of the cooperative agreement is included.

Experimental investigations of vaccination (per os and subcutaneously) against infectious (paratyphoid) abortion in mares [trans. title], B. M. Gurwitsch (*Ztschr. Infektionskrank. u. Hyg. Haustiere, 38 (1930), No. 1, pp. 23–36; abs. in Vet. Bul., 1 (1931), No. 1, pp. 29, 30*).—The author reports upon tests of both the subcutaneous and ingestion methods of vaccination against equine abortion, in which the vaccine was prepared from 50 strains of *Bacterium abortivo-equinus*. Of the 2 mares tested by intravenous injection 1 aborted and 1 died and of the 4 infected per os 2 foaled normally and the foals of the other 2 died of joint ill. From 1 of the foals *B. abortivo-equinus* was isolated. He found in the attempted vaccination by ingestion that it appeared to render the animal more sensitive to infection. It is concluded that the agglutination test is of no prognostic value, since a high agglutination titer does not of necessity mean that abortion will occur.

Abortion accompanies Brucella suis infection in a sow, H. W. Johnson and L. B. Sholl (*Michigan Sta. Quart. Bul., 13 (1931), No. 4, pp. 209–211*).—This is a full report of the findings in the case of the single brood sow that aborted out of 43, from a large herd, in which Brucella agglutinins appeared during the year. *B. suis* was isolated from the spleen, liver, kidney, and epididymis of a guinea pig inoculated with material taken from the fetal membranes. Pure cultures of *B. suis* were obtained from the lungs, liver, spleen, and kidney of each of the aborted pigs. This type of the organism was also isolated from the spleen and from the supramammary and submaxillary lymph nodes of the sow at the time she was killed. It is pointed out that the lesions described are very similar in nature to those occurring in the reproductive organs of cows infected with *B. abortus*, although of the placentas and reproductive organs from many sows that were examined by the authors not another one has shown the marked lesions in both the placentas and uterus such as were found in this sow.

The diagnosis and control of mastitis, D. H. Udall and S. D. Johnson (*Cornell Vet., 21 (1931), No. 2, pp. 190–206*).—This extended account includes data presented in tabular form.

Directions for the serum-simultaneous anti-rinderpest inoculation of cattle, H. Cooper (*Indian Jour. Vet. Sci. and Anim. Husb., 1 (1931), No. 1, pp. 1–13, pls. 15*).—A detailed account is given for the application of the serum-simultaneous method of active immunization of cattle against rinderpest.

Germicidal efficiency of orthophenylphenol against Mycobacterium tuberculosis, F. W. Tilley, A. D. MacDonald, and J. M. Schaffer (*Jour. Agr. Research* [*U. S.*], *42* (*1931*), *No. 10*, *pp. 653–656*).—The limitation, due to strong odor, in the use of saponified cresol solution, the most commonly used disinfectant readily available on the market and low in cost, led to the investigations here reported, which were conducted with a view to determining the germicidal efficiency against *M. tuberculosis* of solutions of orthophenylphenol prepared by the aid of soap or alkalies.

"Tests were made with solutions of orthophenylphenol prepared by the aid of coconut-oil soap, sodium hydroxide, or calcium hydroxide, against *M. tuberculosis*. After 2 minutes' exposure, orthophenylphenol in a concentration of 1–200 was effective with a soap concentration of 1–100 but was not effective with a soap concentration of 1–20 in the presence of a considerable amount of organic matter. Under similar conditions a concentration of 1–400 with a soap concentration of 1–200 was not effective. Solutions containing orthophenylphenol in a concentration of 1–400 with coconut-oil soap in a concentration of 1–200 or with just enough sodium hydroxide or calcium hydroxide to yield the neutral sodium or calcium salt of orthophenylphenol were uniformly effective after 30 minutes' exposure. Solutions containing orthophenylphenol in a concentration of 1–600 and coconut-oil soap in a concentration of 1–300 were sometimes effective . . . and sometimes ineffective . . . after 60 minutes' exposure."

Undulant fever, with special reference to a study of Brucella infection in Iowa, A. V. Hardy, C. F. Jordan, I. H. Borts, and G. C. Hardy (*U. S. Pub. Health Serv., Natl. Inst. Health Bul. 158* (*1930*), *pp. X+89, pls. 7, figs. 15*).—Following an introduction and a historical account, the subject is taken up under the headings of etiology, bacteriology, and immunology (pp. 8–24); *B. abortus* infection in animals (pp. 24–27); epidemiology (pp. 27–42); clinical information (pp. 42–66); prevention (pp. 66–69); appendix (pp. 69–84); and bibliography (pp. 84–89).

Treatment of undulant fever with an autogenous antigen, G. S. Schilling, C. F. Magee, and F. M. Leitch (*Jour. Amer. Med. Assoc.*, *96* (*1931*), *No. 23*, *pp. 1945–1948*, *figs. 2*).—The authors describe a method of preparing a highly concentrated, relatively soluble, autogenous antigen which on intramuscular injection caused in 48 hours a complete and permanent subsidence of an infection due to *Brucella suis*.

Fertility studies in the bull, I, II (*Jour. Amer. Vet. Med. Assoc.*, *78* (*1931*), *No. 5*, *pp. 658–664, 665–680*).—This contribution from the Oregon Experiment Station is in 2 parts.

I. ***Studies of the genitalia of bulls obtained from the abattoir*, C. R. Donham** and B. T. Simms.—These studies are based upon records taken in the examinations of the genitalia of some 201 bulls.

The authors found that "the most common gross lesion observed was the presence of adhesions in the scrotum. The cause of these adhesions was not determined. They were not associated with the presence of agglutinins for *Brucella abortus* in the blood sera. These adhesions were not associated with either gross or microscopic changes which could be observed in the genital organs. Motility of the spermatozoa was not apparently any less in animals showing such lesions than in those without them. The seminal vesicles showed considerable variation in size, consistency, and color. The most frequent abnormal condition in these organs was a fibrosis. The examinations of fresh material resulted in finding motile spermatozoa in all portions of the testicle and the ducts leading from it. The ampulla of the ductus deferens was the most satisfactory organ for the collection of spermatozoa for microscopic examinations. The character of the secretions in the ampulla varied from thin, watery,

and almost clear, to thick, tenacious, and cream colored. The thick, tenacious, cream-colored secretions usually contained large numbers of spermatozoa. The thin, watery, clear secretion usually contained only small numbers of spermatozoa. In those specimens which were thick and cream colored dilution with 0.85 per cent sodium chloride seemed to increase the motility.

"Secretions of the seminal vesicles either retarded or inhibited motility of spermatozoa. Sperm cells were observed which showed vigorous movement, came to a complete rest, and then showed vigorous movement again. The various abnormalities in morphology which have been described were not observed in these fresh secretions. Stained specimens of the same secretions showed occasional cells with the head and tail separated. The percentage of such forms was materially increased through excessive manipulation of the cells."

II. *The relation of the microscopic findings in semen to its fertility*, C. R. Donham, B. T. Simms, and J. N. Shaw.—"In this group of studies approximately 40 per cent of the bull services resulted in pregnancies. There was a definite relation between the microscopic picture of the semen and the percentage of conceptions following the matings at which such specimens were collected. Pregnancies sometimes, but not frequently, resulted from seminal specimens which were recorded as being distinctly below normal through microscopic examination. There were marked variations in the appearances of seminal specimens from the same bull. It was impossible, therefore, to determine from a single examination what might be expected from other examinations of specimens from the same animal. In the entire group of bulls which were examined more than twice each, there was no animal which always showed normal motility of the spermatozoa. There was no evidence of any relation between promptness and vigor of service and either the seminal picture or the percentage of resulting pregnancies. There was no relation established between frequency of coition and either pregnancies or estimated percentages of motility in bulls which were not being used excessively. Measurements of spermatozoa did not prove of any value in determining the breeding efficiency of the bull. Attempts at determining the H-ion concentration by both the colorimetric and electrometric methods were unsatisfactory when used on mixtures of vaginal discharges and semen. The physical appearance of the mixture of vaginal discharge and semen varied very considerably in the different specimens."

Clinical, bacteriological, and physio-chemical studies of the pregnant bovine uterus, R. L. CONKLIN, J. B. MCCARTHY, R. R. THOMPSON, and L. I. PUGSLEY (*Cornell Vet., 21 (1931), No. 2, pp. 177–187*).—In bacteriological studies commenced in 1923, in the course of which 80 uteri were examined, 9 were found sterile while 71 showed a definite bacterial flora. Of the 17 genera of microorganisms detected those that occurred in a frequency of 10 per cent or more are as follows: Micrococcus 35, Bacillus 26.2, Escherichia 23.7, Streptococcus 21.2, Alcaligines 17.5, and Staphylococcus 10. The correlation between the bacterial flora genera of microorganisms isolated from uterochorionic space and the amniotic fluid is summarized in tabular form, as is the frequency of generic types in pregnant bovine uteri.

It was observed that "all uteri having an amniotic fluid of high acidity contained microorganisms capable of forming acid from sugars and from milk. All amniotic fluids showing a high density have a large microflora. All amniotic fluids showing a high nitrogen content showed a microflora. All uteri listed as bacteriologically sterile were shown by chemical analysis to have a normal amniotic fluid. All uteri considered clinically as diseased contained microorganisms. The genus Alcaligines appeared to be more easily isolated from the amniotic fluid. *A. abortus* was not found in pure culture in any of the material studied. It appeared associated with other bacterial

forms. There was an increase in amino acid nitrogen and total nitrogen content in the diseased specimens. In pathological specimens there was a decrease in the carbon dioxide content. This may have been due to the buffer action of the increased nitrogen products."

The data obtained in the chemical studies are said to demonstrate that "the density of the fluid and the freezing point depression give an indication as to the state of the fluid. The pH of the fluid from clinically normal cases remains fairly uniform at 6.85, whilst the clinically diseased specimens varied from pH 5.46 to 7.20. The dry matter and the loss upon ignition in the diseased specimens were constantly higher than the maximum for the normal specimens. The Ca-P ratio for normal specimens decreased as pregnancy advanced, whereas the reverse was the case in diseased specimens. The average K-P ratio of both normal and diseased was at a maximum at the end of the 12 weeks. The averages for later periods decreased. A low Cl content was accompanied by a high PO_4 content in disease."

Warts on cattle, G. T. Creech (*U. S. Dept. Agr. Leaflet 75 (1931), pp. 4, figs. 3*).—A brief practical account.

The etiology of infectious diarrhea (winter scours) in cattle, F. S. Jones and R. B. Little (*Jour. Expt. Med., 53 (1931), No. 6, pp. 835–843*).—A disease of cattle manifested by severe diarrhea and characterized by frequent passage of dark brown or black feces, often containing mucus and blood, is described. Catarrhal inflammation of the small intestine and liver degeneration are said to be the principal lesions.

"By feeding feces from spontaneous cases to calves a similar but milder disease characterized by the same type of enteritis was produced. Vibrios were cultivated from the inflamed intestinal tract of such experimentally induced cases. Pure cultures of the vibrios when fed to other calves, in certain instances, produced diarrhea and a well-marked enteritis similar to that observed in both the spontaneous disease and in calves following the feeding of feces from naturally affected cows. Vibrios were recovered from the inflamed small intestine of three out of four animals fed such cultures."

Three-day sickness of cattle: A résumé of the literature, S. K. Sen (*Indian Jour. Vet. Sci. and Anim. Husb., 1 (1931), No. 1, pp. 14–23*).—This review of the literature is accompanied by a list of 33 references.

Vibrios (Vibrio jejuni n. sp.) associated with intestinal disorders of cows and calves, F. S. Jones, M. Orcutt, and R. B. Little (*Jour. Expt. Med., 53 (1931), No. 6, pp. 853–863, pl. 1*).—A number of vibrios obtained from the small intestines of calves fed feces from spontaneous diarrhea in cows, natural intestinal disorders of calves, experimentally induced infections of calves, and cultures were studied. From the close morphological resemblance, similarities in motility, position and number of flagella, tinctorial properties, and the tendency to fragmentation in older cultures, as well as the narrow nutritive requirements, the authors were led to consider them as a closely allied group, for which the name *V. jejuni* is proposed.

Vibrionic enteritis in calves, F. S. Jones and R. B. Little (*Jour. Expt. Med., 53 (1931), No. 6, pp. 845–851*).—An intestinal disorder of calves, the clinical manifestations of which are usually observed in calves two or more weeks old, is described.

The experiments conducted indicate that "infection may take place relatively early in life and may for a time produce only a mild reaction, but as the disease becomes more chronic the clinical manifestations become more pronounced. The anterior portion of the jejunum is the primary locus of infection, but in more chronic cases practically the whole small intestine may be involved. Vib-

rios were cultivated from the inflamed intestinal mucosa in both the acute and more chronic spontaneous cases. Vibrios were also obtained from the acutely involved intestine of young calves experimentally exposed to natural infection. On three occasions similar vibrios were found in cultures from the liver. When a single strain of vibrios which had been under cultivation for three months was fed to a young calf subclinical infection was produced and the organism recovered. This strain after three passages on media when fed to a calf produced a severe inflammation of the jejunum and ileum, and from these areas the organism was recovered."

Infectivity of the cells of hog cholera blood, W. RUCKS and C. MURRAY (*Jour. Amer. Vet. Med. Assoc., 78 (1931), No. 5, pp. 691–702*).—In a series of five experiments conducted in which the cells of hog cholera blood were separated from the serum and repeatedly washed with physiologic salt solution, it was clearly demonstrated that they are highly infective after 6, 8, and 16 washings, although practically all virus is removed or is so diluted by the washings that it is beyond the possibility of infectivity. The virus contained in the cells, released by hemolysis and then filtered through Berkefeld candles, possessed sufficient virulence to produce typical hog cholera when injected in minute dosage into susceptible pigs.

The etiology of swine influenza, R. E. SHOPE (*Science, 73 (1931), No. 1886, pp. 214, 215*).—A report of work with swine influenza or "hog flu," first recognized as a clinical entity in 1918, since which time it has reappeared in epizootic form each fall and winter in the swine-raising States of the Middle West. Eight strains of the disease have been established among experimental swine during the three years it has been under the author's investigation at the Rockefeller Institute for Medical Research at Princeton, N. J.

The results obtained indicate that a filtrable virus is the primary inciting agent. Since, however, the influenza-like bacillus is always found in field and experimental cases and is capable experimentally of converting the mild disease caused by the filtrate into clinically and pathologically typical swine influenza, it is considered probable that both the filtrable agent and the bacillus are etiologically essential to the production of the disease and that in this rôle they act synergistically.

Immunization of dogs against rabies by the one-injection method, H. W. SCHOENING (*Amer. Jour. Pub. Health, 21 (1931), No. 6, pp. 637–640*).—From work conducted by the U. S. D. A. Bureau of Animal Industry it would appear that "phenol-killed vaccines are capable of producing immunity in dogs when given in one dose, but also that failures of this type of vaccine are to be expected and a false sense of security should not obtain because of vaccination. The possibilities of postvaccinal paralysis with this type of vaccine should be recognized, and no absolute assurance should be given that no harm to the dog will result. From the data available it appears that the chloroform-treated vaccine is superior to the phenol vaccine in both potency and safety, but final judgment must await its use in the field."

Fowl-pox and coryza, J. R. BEACH (*North Amer. Vet., 12 (1931), No. 5, pp. 35–41*).—This is an account of the results of investigations of fowl pox and coryza conducted in the United States, presented in connection with a list of 32 references to the literature.

Intense parasite recurrence due to splenectomy in the course of a latent infection of Aegyptianella in the fowl [trans. title], E. BRUMPT (*Compt. Rend. Acad. Sci. [Paris], 191 (1930), No. 21, pp. 1028–1030*).—This is a report of a study made of the effect of splenectomy on two fowls previously heavily infected with *A. pullorum*, but which had ceased to show any parasites in their

blood. Following the operation the parasites reappeared and increased in numbers, but the infection later died out and the fowls recovered.

The use of nicotin and its compounds for the control of poultry parasites, C. D. Carpenter (*Jour. Amer. Vet. Med. Assoc., 78 (1931), No. 5, pp. 651–657*).—This is a practical summary of information presented at the meeting of the American Veterinary Medical Association, held in Los Angeles, Calif., in August, 1930.

Experimental examination of the Lahaye vaccine against pigeon pox [trans. title], K. Rasch (*Ztschr. Infektionskrank. u. Hyg. Haustiere, 38 (1930), No. 1, pp. 37–41; abs. in Vet. Bul., 1 (1931), No. 1, pp. 54, 55*).—The author concludes that the Lahaye vaccine is a mixture of pigeon and fowl pox virus, the former predominating. The reactions to vaccination were found to be very pronounced in pigeons, but no active immunity against pigeon pox could be demonstrated. The vaccine was heavily contaminated with a bacillus of *Bacillus enteritidis* Breslau type, and it is considered probable that some of the lesions produced in the experimental animals were due to this organism. It is considered possible that the birds from which the vaccine was prepared were suffering from a latent infection.

AGRICULTURAL ENGINEERING

Report on experiments carried out at the Karachi Model Testing Station on a model of a flumed regulator, C. G. Hawes and H. S. Kahai (*Bombay Pub. Works Dept., Tech. Paper 31 (1929), pp. [3]+7, pls. 9, fig. 1*).—Studies of certain points in flume design are reported. These show that to minimize the loss of head through a regulator which is flumed it is definitely better to have a 1:10 expansion on the downstream side than to have a 1:5 expansion. The loss of head through such a regulator is not influenced to any appreciable extent by the shape of the ease waters of piers. The 1:5 cutwater is so little better in regard to loss of head than the curved cutwater (with a radius equal to double the width of the pier) that it will not pay to adopt 1:5 cutwaters.

It is also concluded from the experiments with two piers in the throat that the splitting up of the water passing through the throat by means of piers into small streams has very little effect on the loss of head through a regulator, and that the introduction of piers into a regulator will not, therefore, affect appreciably the loss of head which will obtain in practice through the regulator.

A note by W. A. Evershed is included.

Meters for farm equipment studies (*[C. R. E. A.] Natl. Rural Elect. Proj., College Park, Md., Rpt. 4 (1931), p. 1, figs. 3*).—A simple cost meter and special portable watt-hour meters are briefly described and illustrated.

The quarter horsepower portable motor on the farm (*[C. R. E. A.] Natl. Rural Elect. Proj., College Park, Md., Rpt. 3 (1931), pp. 8, figs. 20*).—The use of the quarter horsepower portable motor for different small belt power purposes on the farm is described and illustrated.

Knock rating of motor fuels, C. H. Barton, C. H. Spraké, R. Stansfield, and O. Thornycroft (*S. A. E. [Soc. Automotive Engin.] Jour., 28 (1931), No. 6, pp. 636, 641*).—Experiments conducted by the Institution of Petroleum Technologists are reported, in which various fuels, both straight-run and blended, were tested in the Ricardo, Delco, and Armstrong engines under three different sets of conditions and were rated in terms of blends of a high value and a low value straight-run gasoline, benzene, and heptane and iso-octane and heptane. The last method gave a greater degree of fluctuation in knock intensity than the benzene-heptane blend.

Report on farm electrification research, compiled by G. W. Kable (*C. R. E. A. Bul.* [*Chicago*], *6* (*1931*), *No. 1, pp. 79, figs. 4*).—The results of a survey of problems for solution on the use of electricity in agriculture are presented in this report. The first part summarizes the progress of investigations of different types which have been conducted. It contains an analysis of agricultural development and a listing of some of the major economic and production problems in which electricity may be involved. It also proposes a plan and a program for the continuation of research activities. The second part classifies by subject the investigations under way and proposed, and in some cases brief statements of results are given. A list and description of research agencies engaged in rural electrification are included.

Rural electrification in Virginia, C. E. Seitz and V. R. Hillman (*Va. Agr. Col. Ext. Bul. 122* (*1931*), *pp. 51, figs. 57*).—The purpose of this bulletin is to explain the plan in operation in the State of Virginia for extending electric high-line service to rural sections and to indicate a few of the more important farm operations which are now being performed to advantage with electric power on Virginia farms. The report of a joint committee on rural electrification is appended.

Method of computing machinery costs, E. C. Sauve (*Michigan Sta. Quart. Bul., 13* (*1931*), *No. 4, pp. 187–190, fig. 1*).—This method is briefly outlined as it refers particularly to the machinery on Michigan farms. It deals with both operation and overhead costs, and graphic data are presented for their computation

Nebraska tractor tests, 1920–1930 (*Nebraska Sta. Bul. 255* (*1931*), *pp. 28, fig. 1*).—This bulletin summarizes the results of 64 tractor tests and includes data on all tractors reported by their manufacturers as on the market January 1, 1931. Beginning with 1928, the "one carburetor setting" method was adopted, and all results shown in the reports of tests made from 1928 to 1930 were attained with the carburetor adjustment remaining unchanged throughout all parts of the complete test.

Cotton harvesting development to date, H. P. Smith (*Agr. Engin., 12* (*1931*), *No. 3, pp. 73–78, figs. 11*).—In a contribution from the Texas Experiment Station, a brief review of the status of cotton harvesting development is presented, with particular reference to mechanical methods. After considering all the various types of cotton harvesters, the conclusion is drawn that it is difficult for any and all types to handle the crop, largely because the nature of the cotton plant itself is largely responsible for retarding the development of a successful mechanical harvester. With this in mind, the station is attempting not only to develop a cotton harvester but also to develop a variety of cotton which will be well suited to mechanical harvesting.

Silo filling methods and costs, M. M. Jones and D. D. Smith (*Missouri Sta. Bul. 303* (*1931*), *pp. 32, figs. 14*).—The results of studies of silo-filling methods in common use in Missouri, with a view to determining how the expense, labor, and trouble of filling silos may be reduced, are reported. The method of conducting these studies was largely of a survey character and involved consideration of the practices on 326 Missouri farms.

It was found that the binder method of cutting requires less labor, but the machinery costs are higher. The average cost for 110 binders was 82 cts. per acre and 16 cts. per ton. It requires less labor to handle bound corn than to handle unbound corn. An average of about 0.3 man hour per ton is required to load the corn onto wagons, haul it to the silo, and feed it through the silage cutter, when it is bound. It appears that on the average the binder method is cheaper than the hand method where the acreage of corn cut is more than from

30 to 35 acres per year and is cheaper than the sled method for acreages above 50 acres per year. For less than 12 acres per year, the hand method is cheaper than the sled method. Gasoline tractor power for operating the silage cutter averaged about 75 cts. per hour and about 20 cts. per ton where the tractor was owned by the farmer. A gasoline tractor or electric motor that requires no operator was found to be cheaper than an engine or tractor requiring an operator. The field silage harvester method of making silage was found to require less labor than other methods, but the machine cost is higher.

Farm grinding of grain and forage, F. C. Fenton and C. A. Logan (*Kans. Engin. Expt. Sta. Bul. 27 (1931), pp. 48, figs. 25*).—Investigations conducted by the Kansas Engineering Experiment Station in cooperation with the Kansas Agricultural Experiment Station are reported. They represent also cooperation between the departments of agricultural engineering and animal husbandry.

The results indicate that it is profitable under most conditions to grind small grains for livestock, but that the advisability of grinding roughage, unless it contains grain, has most of the evidence against it.

Both hammer and plate type mills show advantages. The combination mill is suitable for a wider variety of grinding than the other types, while the hammer mill is better adapted for fine than for coarse grinding. The roller mill is ideal for cracking or coarse grinding, and the plate mill is better adapted for coarse than for fine grinding. It was found that the power required for grinding does not vary greatly with the different types of mills.

The fixed charges, such as interest and depreciation, are the largest items in the cost of grinding unless a large quantity of grain is ground annually. Grinding can be done more cheaply with a small mill and a small power unit than with large ones. It was found that a small automatic mill eliminates much of the labor cost of grain grinding and does the grinding most economically. The electric motor is an ideal power unit for grain grinding, and the cost of its power is about the same as that of gasoline engine power. Excessively fine grinding of grain greatly increases the power cost, and the power required increases as the moisture content of the grain increases. It was found that the peripheral speed of the hammers and not the number of revolutions per minute is effective in grinding.

Grinding roughage requires more power than grinding grain, and in grinding roughage it pays to grind fine enough to crack all of the grain. It was found that it does not pay to chop roughage, but it does pay to grind kafir fodder. The total cost of grinding roughage, including labor, power, and equipment, may range from 98.6 cts. to $1.39 per ton. Knives for the first reduction in a roughage mill decreased the power required and increased the uniformity of grinding.

Running the silage cutter at high speeds is a waste of power. A speed of from 500 to 600 r. p. m. was found to be most economical.

A bibliography of 14 references to literature on the subject is included.

Small farm feed grinder (*[C. R. E. A.] Natl. Rural Elect. Proj., College Park, Md., Rpt. 2 (1931), pp. 3, figs. 4*).—A semiautomatic burr mill for operation with a quarter horsepower portable motor is briefly described and illustrated, and cost and other data are given from performance tests.

Prevention of wind and fire losses to farm buildings, H. Giese (*Iowa Sta. Circ. 127 (1931), pp. 23, figs. 31*).—Attention is drawn to some of the easily observed preventive measures for the reduction of farm building losses resulting from wind and fire. Information is given on wind resistive and fire resistive construction, and especially to considerations in farmstead planning,

with particular reference to building design. A list of 12 publications dealing with wind and fire losses and their prevention is included.

AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY

Outlines of agricultural economics, H. C. Taylor (*New York: Macmillan Co., 1931, rev. ed., pp. XII+614, figs. 68*).—This is a revision of the textbook previously noted (E. S. R., 53, p. 694) "to conform to important progress which has taken place in the field of cooperation, the Federal agricultural marketing services, and particularly with respect to the new public policies relating to the share of agriculture in the national income."

Elements of the mathematical theory of statistics, with forestry and economic applications, W. J. Kirkham (*Corvallis, Oreg.: Author, 1931, pp. [1]+105, figs. 15*).—This mimeographed text discusses and illustrates the methods of averaging, measures of dispersion, the theory of probability, sampling, the methods of measuring the correlation or accuracy of prediction, the making of alignment charts, and anamorphic graduation and anamorphic curves. Each chapter is followed by a set of problems.

[Investigations in agricultural economics at the Ohio Station], J. I. Falconer (*Ohio Sta. Bimo. Bul. 151 (1931), pp. 149, 150, fig. 1*).—Results are reported as follows:

Size of Ohio farms.—A map is given showing by counties the average size for the State was 91.6 acres in 1920 and 98.2 acres in 1930. The number of farms under 3 acres, from 175 to 259 acres, and from 260 to 499 acres increased in the decade.

Index numbers of production, prices, and income.—The table of index numbers previously noted (E. S. R., 65, p. 481) is brought down through May, 1931.

Natural geographic divisions of land, J. O. Veatch (*Mich. Acad. Sci., Arts, and Letters, Papers, 14 (1930), pp. 417–432, fig. 1; abs. in Michigan Sta. Quart. Bul., 13 (1931), No. 4, pp. 222, 223*).—Homogeneity in soil, topography, and vegetation is used as the basis for dividing the lands of Michigan into 67 natural land divisions. A map with legend showing the soil, topography, and vegetation of each division is included in the original article.

Type of farming areas in Texas, C. A. Bonnen and F. F. Elliott (*Texas Sta. Bul. 427 (1931), pp. 84, figs. 37*).—The physical, biological, and economic factors in the agricultural development of Texas and the geographical distribution of crops and livestock in the State are described. Maps are included showing the distribution of different crops and kinds of livestock and the 20 type-of-farming areas of the State. The several areas and the factors contributing to their development, the reasons for variations of systems of farming within the areas, the typical systems in each area and the method of determining such systems, and the changes in organization since 1925 are discussed. The uses that may be made of type-of-farming studies are briefly described.

This study was made in cooperation with the U. S. D. A. Bureau of Agricultural Economics.

Three-year study of farm management and incomes in a typical upland section of Arkansas, J. A. Dickey (*Arkansas Sta. Bul. 262 (1931), pp. 58, figs. 8*).—This study of the east-central and west-central districts of Faulkner County is based upon field records for 1924, 1925, and 1926, showing details of farm organization, operations, receipts, expenses, etc. Preliminary results for 1924 have been previously noted (E. S. R., 61, p. 580).

The area and the economic conditions in the area are described. Tables are included and discussed showing for each of the three years for the different farm groups—all farms, 40, 80, 120, 160, and 180 acres and over—the utilization

of land, acreages in different crops, crop yields, numbers of different kinds of livestock, production per cow and per hen, percentages and values of feed and food consumed and sold, sources and value of cash receipts, farm expenses by items, distribution of investments, and financial results. The effect of size of business, selection and combination of enterprises, and efficiency in operations on earnings are analyzed. A table is included comparing the factors of organization and management for the 25 per cent of the farms in each size group having the highest labor income in 1926 with the averages for all the farms in the group.

The study showed little difference in the kind and number of crops and enterprises as between the individual farms. The most marked difference in farming types was in size of farms. Differences in combinations and to some extent in selection of enterprises to supplement cotton were largely due to the size of the farm. The percentages of land in cultivated crops and of cultivated land in cotton decreased from 74 and 53 per cent, respectively, for the 40-acre group to 37 and 48 per cent, respectively, for the 160-acre group.

The number of dairy cows per farm averaged 1.5 for the 40-acre group and 3.4 for the 160-acre group. The number of animal units per acre of the entire farm and per acre of pasture decreased with the increase in size of farm. On the larger farms there was a smaller proportion of capital invested in buildings and a slightly larger proportion in operating equipment than on the smaller farms. Machinery costs per acre were nearly twice as large on the smaller farms. The number of work stock increased with the size of farm, but on the 40-acre farms there were only 20 acres per horse as compared with more than 40 acres on the 160-acre farms. On the 40-acre farms there were 289 productive units of man work and 193 days of productive work per man, as compared with 593 units and 349 days on the 160-acre farms. Operator's earnings increased each year with the size of farm.

It was found that in general for the 40-acre and 80-acre farms the productivity was increased through increasing the acreage of cotton, while for the larger size groups it was increased by increasing the acreages in crops other than cotton and in pasture and by enlarging the livestock enterprise. The most important needs for improving the agriculture of the areas were found to be larger farms on the better soils and a type of farming combining cash crops and livestock.

Production study of 160 dairy herds, Wellsville, Utah, 1929, G. Q. Bateman (*Utah Sta. Bul. 229 (1931), pp. 13, figs. 5*).—Data for the year 1929 regarding number of dairy cattle, size of farms, acres in different crops, and crop yields were obtained by questionnaires from the farm operators, and data regarding milk and butterfat sold per farm and money paid to the dairymen from the records of the condensed milk plant. The 160 herds included 1,682 milch cows and 840 heifers. Comparisons of milk and butterfat production and sales are made with the average for 1926–1929 for the station's dairy experimental herd.

Tables are included showing for the herds, grouped as to size, the acres and yields per farm of different crops and the average number of cows and heifers and the production of milk and butterfat per farm and per cow. Other tables show for the 160 herds for 1929 and the dairy experimental herd (average for 1926–1929) the amount of milk and butterfat sold per day by months, the percentages of butterfat by months, the monthly prices paid for butterfat, and the monthly total payments.

The average amount of butterfat sold per cow per year for the 160 herds was 288 lbs., as compared with 306 lbs. for the experimental herd. The number

of pounds of milk sold per day decreased 36 per cent from June to November for the 160 herds, as compared with a decrease of 21.4 per cent from June to October for the experimental herd. This more rapid decline in production of the 160 herds could be reduced by extra feed and care during the late summer and fall months.

Comparison of the production per cow in the 160 herds showed the average production increased with each year the herds had been included in cow-testing associations, being 6,527 lbs. of milk with 234.6 lbs. of butterfat for herds never in an association to 7,443 lbs. of milk and 260.4 lbs. of butterfat for those that had been in an association for 5 or more years.

The farm business in Saskatchewan.—Studies Nos. 1–3, W. ALLEN (*Saskatchewan Univ., Col. Agr. Ext. Buls. 37 (1927), pp. 100, figs. 16; 43 (1928), pp. 99, figs. 19; 46 (1930), pp. 111, figs. 24*).—This series of bulletins gives the results of surveys made by the Department of Farm Management of the College of Agriculture of the University of Saskatchewan.

The Belback district, the area covered in the first study, is located north of Moose Jaw and is representative of a large number of farms on the heavy clay land of the Regina till plain. The climate, soils and other physical conditions, the population, and the agricultural development of the district are described, and other data are tabulated and discussed regarding the place of birth, age, farming and other experience, education, size of family, etc., of the farm operators, savings of owners, farm credit, labor, capital, lands, buildings, implements and machinery, income, expenses, crop and livestock production, farm organization and practices, cost of production, and efficiency of man labor and horse work. The weed menace, the farmstead and shelter belt, family living expenses, and rented farms are also described and discussed.

The second study applies to the Melfort district, typical of the lands usually found on the northern borders of the open prairies, and the third to the Alameda district, which is fairly well representative of a considerable area of southeastern Saskatchewan and southwestern Manitoba.

Agriculture and the business cycle since 1920, C. A. WILEY (*Wis. Univ. Studies Social Sci. and Hist. No. 15 (1930), pp. X+237, figs. 31*).—"The chief aim of this study has been to seek out and isolate for this postwar period some of the primary factors contributing directly or indirectly to the recent disparity of agricultural prices in comparison with those of the nonagricultural commodities group." It deals chiefly with the causes of the disparity of agricultural prices rather than the effects on farmers' net incomes. Part 1 discusses the relative position of agriculture compared with other industries, the objective and method of the study, commodity price relationships and the economic position of agriculture, and the similarity of the present position to the position of English agriculture following the Napoleonic wars. Analyses are made in part 2 of the factors which tended to affect both absolutely and relatively the supply of agricultural products after the war, and in part 3 of the primary factors following the war which tended to affect the amount or intensity of the demand for agricultural products.

On the basis of effect the following causes of the agricultural depression are selected by the author: (A) Factors contributing to the relative oversupply of farm products, (1) production in the western world stimulated by war-time prices, due to interruption of European production and interference with accustomed European trade relations by practices of submarine warfare; (2) inability or disinclination of the countries of the western world to curtail production after the war, due chiefly to slow turnover, nature of farming co[illegible], individualism in production, and uncertainties of weather factors; (3) [illegible]

tively rapid agricultural recovery of Europe after the war, together with programs for national self-sufficiency; (4) restoration of trade with, and normal production programs in, countries isolated by the war such as Denmark and New Zealand; (5) marked curtailment in volume of industrial production; and (6) Federal reserve policy overstimulated optimism and production in agriculture for the crop year 1920. (B) Factors tending to decrease the demand for American farm products after the war, (1) competition with other sources of supply, i. e., Denmark, Argentina, New Zealand, etc.; (2) greater self-sufficiency of western Europe; (3) adjusted consumption by substitution and dilution; (4) decreased purchasing power resulting from tariff barriers, curtailed credit, and the international exchange situation; (5) curtailed industrial production; and (6) unemployment in the United States and Europe.

The following four means of adjustment are discussed: (1) "The unsocial and painful process of individual selection of enterprises on the basis of capacity for yielding income; (2) the tendency of a growing postwar demand eventually to overtake production; (3) the results obtained by intelligent, businesslike cooperative marketing agencies toward adjusting the equation of supply and demand by means of the utilization of every educational and economic device at its command; and (4) such concessions as the Federal and State Governments may make to affect the supply and demand equation for agricultural products, commensurate with certain measures now in operation tending to 'hike' the price of nonagricultural products."

The agricultural situation in 1929–30 (*Rome: Internatl. Inst. Agr. [Bur. Econ. and Social Studies], 1931, pp. XII+174*).—This is an economic commentary on the International Yearbook of Agricultural Statistics for 1929–30 (E. S. R., 64, p. 690). Chapter 1 (pp. 3–27), the agricultural produce market, discusses the conditions of the agricultural produce market throughout the world; chapter 2 (pp. 29–63), government measures of farm relief, consists of notes on the measures taken by different governments in the interests of agricultural producers and the results of such measures; chapter 3 (pp. 65–84), action taken by voluntary organization in the interest of the producers, indicates briefly the efforts made by voluntary associations in different countries to improve the economic conditions of producers; and chapter 4 (pp. 85–132) includes notes on the agricultural situation in different countries, special attention being given to the economic condition of farmers. Chapters 1 and 4 stress the production, marketing, and prices of cereals, especially wheat.

A selected bibliography of books and pamphlets on the agricultural situation in various countries is given in an appendix.

Survey of the wheat situation, August to November, 1930, and December, 1930, to March, 1931, M. K. BENNETT ET AL. (*Wheat Studies, Food Research Inst. [Stanford Univ.], 7 (1931), Nos. 3, pp. [1]+185–229, figs. 8; 6, pp. [1]+295–345, figs. 8*).—The cereal crops of 1930; marketing and stocks of wheat; the international trade; wheat price movements; the outlook for trade, carry-overs, and prices; and the activities of the Federal Farm Board as regards wheat are discussed in the first of these articles, while the second describes and discusses the international trade, visible supplies and other stocks, wheat price movements, the activities of the Federal Farm Board, and the outlook for significant developments in the world wheat situation.

The wheat situation in Scandinavia, H. C. FARNSWORTH ET AL. (*Wheat Studies, Food Research Inst. [Stanford Univ.], 7 (1931), No. 7, pp. [1]+347–403, figs. 34*).—Charts are included showing the major features of the wheat situation in Denmark, Sweden, and Norway, followed by a brief analysis

for each country of the outstanding facts regarding wheat production, consumption, prices, and trade.

The German-Polish Rye Agreement, K. Colegrove (*Jour. Polit. Econ., 39 (1931), No. 2, pp. 213–228*).—The conditions leading up to the setting up of the German-Polish Rye Commission (the first of the interstate syndicates for the purpose of stabilizing agricultural prices) by the Rye Agreement of February 18, 1930, the operations of the commission, and the results obtained are described.

Agricultural credit in the United States, F. L. Garlock (*[Internatl. Rev. Agr.], Mo. Bul. Agr. Econ. and Sociol. [Rome], 22 (1931), No. 2, pp. 41–55*).—The mortgage credit and production and marketing credit facilities and the problems and experiences of each type of organization are described.

A statistical study of the problem of making long-term mortgage loans on farm property in New York State, F. F. Hill (*Thesis, Cornell Univ., Ithaca, N. Y., 1930, pp. [14]+194+[23], figs. 10*).—This doctorate thesis is based on the loaning operations of the Federal Land Bank of the First Federal Land Bank District from its organization in 1917 to May 31, 1929. The loaning operations of the bank, the agricultural situation from 1917 to 1929 in the district, the four areas of New York studied, and the loaning experience of the bank in each area are described. The effects on foreclosures and losses of the character of the farm (soil, elevation, quality of tillage land and of entire farm, type of road and distance to market, conditions of buildings, and size of farm), of type of farming, of nationality and experience of borrower, of age of operator, of manner in which farm was acquired, of equity of borrower in farm, of size of loan, and of year in which loan was made are analyzed. The provisions of the Federal Farm Loan Act relative to operating margin and the adequacy of a 1 per cent margin are discussed, and comparisons are made of the earnings and losses of the Federal Land Bank and national banks.

The following were found to be important factors affecting the safety of loans: (1) A farm being both a home and a business, anything making it a more desirable place to live or a better place to make a living increases the safety of a loan; (2) the foreclosure rate is considerably lower on farms appraised at relatively high value per acre than on those appraised at a low value; (3) the farm is more important than the personal qualifications of the borrower or his equity in the farm; (4) farms of less than 20 acres were found to have been excellent risks; (5) loans on poultry farms were first-class risks; (6) the foreclosure rate on farms located on hard roads was only 50 per cent of that for all farms; (7) the percentage of foreclosures decreased as the appraised value of buildings increased; (8) loans on farms in deficit areas near cities were excellent risks; and (9) foreclosures and losses were highest in the marginal territory of the south-central part of the State.

In the opinion of the author, an operating margin of 1 per cent is not sufficient for a Federal land bank with only $50,000,000 of mortgage loans, especially in a period of a falling money market.

An analysis of the South Carolina Agricultural Loan Association, W. H. Rowe (*U. S. Dept. Agr., Bur. Agr. Econ., 1931, pp. [2]+30, pls. 2*).—This preliminary mimeographed report describes and discusses the characteristics, operating practices and policies, loan experience, income, costs, and profits, and the conditions and expedients since 1928 of the association; the factors responsible for the heavy losses; rediscounts and relations with the Federal Intermediate Credit Bank; and interest rates and costs to borrowers.

The Texas Cotton Growers' Finance Corporation, W. H. Rowe (*U. S. Dept. Agr., Bur. Agr. Econ., 1931, pp. [2]+38, pls. 3*).—This preliminary mimeographed report describes and discusses the characteristics of the corporation,

types of loans, the measures of protection against loaning risks, the loan experience of the corporation, its rediscounts, interest charges and other costs to borrowers, and its income, costs, and profits.

Report of proceedings of tax conference, 1931 (*[Chicago: Amer. Farm Bur. Fed.], 1931, pp. 5+100*).—This is a mimeographed report of the conference of national organizations held at Chicago, Ill., February 5 and 6, 1931, upon invitation of the American Farm Bureau Federation.

Marketing principles: Organization and policies, J. F. PYLE (*New York and London: McGraw-Hill Book Co., 1931, pp. XIII+565, figs. 10*).—This textbook presents " (1) a method of analysis and a body of facts which, it is hoped, will aid in a fuller appreciation of the importance of a thorough knowledge of the marketing process and a clearer understanding of the problems connected with the effective buying and selling of tangible goods and of services; (2) a basis for formulating sound generalizations with reference to marketing functions, organizations, policies, methods, costs, and prices; and (3) the point of view that the marketing process is in reality an organizing force which coordinates and ties together the work of numberless, and frequently widely scattered, business and professional specialists." It includes chapters on marketing agricultural products (pp. 173–228) and on cooperative marketing of such products (pp. 419–457). Each chapter is followed by a list of references and questions for discussion.

Organized commodity markets, edited by S. S. HUEBNER (*Ann. Amer. Acad. Polit. and Social Sci., 155 (1931), May, pt. 1, pp. [V]+1-237, 265-268, figs. 7*).—This volume is a successor to American Produce Exchange Markets.[a] Part 1, principles and practices, deals with the important principles, practices, and economic factors essential to all organized commodity markets in papers as follows: The Insurance Service of Commodity Exchanges, by S. S. Huebner (pp. 1–6); The Hedging of Grain, by G. W. Hoffman (pp. 7–22); Hedging in the Cotton Market, by W. H. Hubbard (pp. 23–38); Governmental Regulation of Exchanges, by G. W. Hoffman (pp. 39–55); The Case for the Agricultural Marketing Act, by J. S. Davis (pp. 56–64); Opposing the Agricultural Marketing Act, by C. D. Sturtevant (pp. 65–73); Arbitraging in Grain, by S. C. Harris (pp. 74–78); Relationship of Cash and Future Prices, by W. H. S. Stevens (pp. 79–90); Factors Affecting Prices on Organized Commodity Markets, by G. W. Hoffman (pp. 91–99); and Commodity Exchange Clearing Systems, by H. J. Loman (pp. 100–109).

Part 2, special markets, relates to special commodities not discussed in the previous volume, as follows: The New York Coffee and Sugar Exchange, by E. M. Brunn (pp. 110–118); The Rubber Exchange of New York, by J. L. Julian (pp. 119–126); The Metal Exchange, by I. Reitler (pp. 127–132); Chicago Mercantile Exchange, by L. S. Tenny (pp. 133–135); Provisions Market of the Chicago Board of Trade, by F. H. Clutton (pp. 136–139); New York Cocoa Exchange, by E. A. Canalizo (pp. 140–145); National Raw Silk Exchange, Inc., by A. H. Korndorfer (pp. 146–150); Trading in Hide Futures, by E. L. McKendrew (pp. 151–157); The New York Burlap and Jute Exchange, by J. E. Boyle (pp. 158–160); Exchanges at the Live Stock Markets, by C. A. Wilson (pp. 161–166); Cottonseed Oil Exchanges, by J. E. Boyle (pp. 167–172); Memphis Merchants Exchange Clearing Association, by J. E. Boyle (pp. 173–175); and Possibilities of Organized Markets in Various Commodities, by C. A. Kulp (pp. 176–195).

Part 3, foreign exchange markets, a subject not covered by the previous volume, includes the following articles: Commodity Exchanges in England, by

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[a] Ann. Amer. Acad. Polit. and Social Sci., 38 (1911), No. 2, pp. 1–319, 347–351, figs. 4.

R. B. Forrester (pp. 196–207); Commodity Exchanges in Germany, by H. Hirschstein, trans. by K. W. Scholz (pp. 208–217); Commodity Exchanges in France, by A. de Lavergne, trans. by F. C. James (pp. 218–222); Commodity Exchanges in Japan, by Z. Sano and S. Iura (pp. 223–233); and Commercial Bourses in Italy, by V. Porri, trans. by D. Vittorini (pp. 234–237).

Speculation, short selling, and the price of wheat, A. E. TAYLOR (*Wheat Studies, Food Research Inst. [Stanford Univ.], 7 (1931), No. 4, pp. [1]+231–266, figs. 3*).—The public attitude toward speculation, methods and motives in speculation, the export trade and the futures market, the recent relations of futures prices in Chicago and Liverpool, and the effects of the selling of futures for the Russian account on the Chicago market in September, 1930, are discussed.

Hedging in grain futures, J. M. MEHL (*U. S. Dept. Agr. Circ. 151 (1931), pp. 104, figs. 11*).—This circular deals with the subject especially as it applies to handling grain by country elevators, with a view to explaining the various kinds of protective use to be made of the futures market and some of the fundamentals to be observed in hedging. It is based on data obtained (1) from replies to questionnaires sent to elevators, mostly farmer-owned or privately owned of the local independent type, in Illinois, Iowa, North Dakota, Ohio, and Kansas, and (2) by visits to elevators by men trained in country elevator management and accounting. Certain price data were used to make comparisons between various methods of selling grain. The material is discussed under the following headings: The mechanics of future trading, hedging theory, country practice in use of futures, actual examples illustrating hedging practice, and price results under different methods of sale.

The material is presented with a view to accomplishing the following: "To describe the various uses to be made of the futures market; to distinguish between the use of futures for hedging purposes and their use for purely speculative purposes; to trace a typical futures transaction through the machinery of the grain exchange and explain the various steps involved in its handling; to show what obligations are assumed in futures transactions and how they may be discharged; to show results actually obtained in a number of typical hedging transactions; and to present certain facts and figures bearing upon the relative advantages of various methods of marketing, together with a consideration of the risk-bearing value of the futures market."

An appendix includes excerpts from the rules and regulations of the Board of Trade of the City of Chicago in effect October 18, 1928.

Farm prices of cotton related to quality, Arkansas crop, season 1928–29, L. D. HOWELL (*U. S. Dept. Agr., Bur. Agr. Econ., 1931, pp. [2]+23, figs. 5*).—This is a preliminary mimeographed report of a study made in cooperation with the Arkansas Experiment Station in 14 local cotton markets of Arkansas. The variations in prices with quality in the same markets, the variations in average prices with average quality, and the influence of farm prices on quality of cotton produced are analyzed.

The marketing of wool, A. F. DU PLESSIS (*London and New York: Isaac Pitman & Sons, 1931, pp. XIII+337, figs. 11*).—The mechanism of the distributing process for wool is dealt with in chapters as follows: The production of wool, manufacturing, preparation for the market, standardization, private treaty sale, local public auction sales in England and Wales, central public auction markets, centralization of auction markets, cooperative marketing of wool, control in the marketing, a completely organized market, statistics and market information, short-term credits in wool marketing, and prices over short and long periods.

Statistics of livestock trucking in Iowa, D. A. FITZGERALD (*Iowa Sta. Circ. 128 (1931), pp. 8*).—Tables are included and discussed showing (1) for hogs

by years, 1920–1930, the number marketed, primary destinations (public stockyards, interior packing plants, other packing plants, and concentration points), and marketing from farms through public stockyards, interior packing plants, and other packing plants, and the number trucked, 1920–1930, and the numbers and percentages trucked to public stockyards, packing plants, and concentration points, 1924–1930, and (2) for cattle and calves and sheep the numbers marketed, numbers and percentages trucked to market in 1929 and 1930 and the total marketings and marketings through stockyards and to interior packers by years, 1920–1930.

The co-operative marketing of livestock, E. G. NOURSE and J. G. KNAPP (*Washington, D. C.: Brookings Inst., 1931, pp. XIV+486, figs. 31*).—This volume "attempts to sketch in clear outline (1) the circumstances which have led cooperative livestock groups to organize their several types of marketing enterprise, (2) the objectives which these groups appear to have in mind, whether or not they are reduced to definitely formulated theories, (3) the practical problems and current issues which have arisen with the development of cooperative effort in the face of various evolutionary forces which have been operating in livestock production and marketing, (4) the economic implications of certain forms of organization or procedure now to be found in the movement, and (5) past achievements and the direction of effort and the relative emphasis which seem to promise most for future progress."

The movement by which livestock producers were brought into cooperative selling groups is traced, and the selling agencies at terminal markets, the development of direct marketing activities in different areas, and the results accomplished by cooperative marketing efforts up to the creation of the Federal Farm Board in 1929 are discussed. The proposals of the Federal Farm Board for a national livestock marketing organization and the actual developments are described. The major economic issues—market machinery and practices, price objectives, and stabilization of the industry—now confronting the movement and the cooperative principles and the Farm Board influence are discussed.

Appendixes include the certificates of incorporation and codes of by-laws of the National Livestock Marketing Association and the National Feeder and Finance Corporation and three studies by K. Bjorka as follows: (1) Hog Price Differentials between Principal Terminal Markets (pp. 369–409), an examination of the yearly, seasonal, weekly, and daily behavior of hog prices with reference to the differentials that obtain between a few of the principal terminal markets; (2) The Hog Price Structure at Interior Markets (pp. 410–426), a discussion of the price situation at several interior markets and how it differs from that at terminal markets; and (3) Relationship between Direct Purchases of Hogs and the Level of Hog Prices (pp. 427–450), an analysis of the effect of the increase in the proportion of hogs bought direct by packers during recent years upon the price of hogs and of pork products. This study yielded no statistical evidence to show that the increase in direct marketing of hogs had a depressing effect upon the level of hog prices and the price of pork products.

Agricultural co-operation in Italy, G. COSTANZO ([*Internatl. Rev. Agr.*], *Mo. Bul. Agr. Econ. and Sociol.* [*Rome*], *22* (*1931*), *No. 1, pp. 1–32*).—The reorganization and continued supervision of the cooperative movement as affected by the National Government, the legal basis and fiscal treatment of the societies, and the status and characteristic features of the cooperative credit, labor, collective land holding, and agricultural insurance societies and the societies for supplying farming requisites and for the production and sale of agricultural products are described.

Crops and Markets, [June, 1931] (*U. S. Dept. Agr., Crops and Markets, 8 (1931), No. 6, pp. 201–240, figs. 3*).—Included are tables, charts, notes, reports, and summaries of the usual types; a table showing the annual indexes, 1924–1930, by geographic divisions of the taxes on farm land and buildings; and tables showing by items the 1930 average costs of producing corn, wheat, and oats in the different geographic divisions and cotton by yield groups.

Statistics of meat production, consumption, and foreign trade of the United States, 1900–1930 (*U. S. Dept. Agr., Bur. Agr. Econ., 1931, pp. [1]+10*).—This is a mimeographed preliminary report including tables showing, by years, the number of animals slaughtered and the estimated total under Federal inspection; the estimated production, exports, imports, and consumption of different kinds of meat and lard; and the per capita consumption of dressed meats and lard.

Official and unofficial statistics of international trade in wheat and flour, M. K. Bennett and A. F. Wyman (*Wheat Studies, Food Research Inst. [Stanford Univ.], 7 (1931), No. 5, pp. [1]+267–293, figs. 6*).—Using official statistics and unofficial statistics as published in Broomhall's *Corn Trade News*, comparison is made of the exports, in total, from Argentina, Australia, North America, and some other countries. The total net exports and shipments in international trade and the annual and monthly net exports and shipments from each of the principal countries and areas are analyzed.

Census shows fewer farms in Michigan, E. B. Hill (*Michigan Sta. Quart. Bul., 13 (1931), No. 4, pp. 206–209, fig. 1*).—A map is given showing by counties the number of farms in Michigan on January 1, 1930, and the percentage of change from 1920 to 1930. Tables show the number of farms at different censuses from 1890 to 1930 in 7 northern counties, and the total land in farms, number of farms, and the average number of acres per farm in 9 counties. From 1920 to 1930 the number of farms in the less than 100-acre group decreased more rapidly than the number in other groups. In most counties there was an increase in the number of farms in the 175 to 259 acre group, and in some counties in the 260 to 499 acre group.

Studies in quantitative and cultural sociology (*Amer. Sociol. Soc. [Pubs.], 24 (1930), pp. VIII+286, figs. 12*).—This volume includes the papers read at the twenty-fourth annual meeting of the American Sociological Society, held at Washington, D. C., from December 27 to 30, 1929. The papers bearing directly on rural sociology were as follows:

The Present Outlook for Population Increase, by L. I. Dublin and A. J. Lotka (pp. 106–114); The Agricultural Significance of the Declining Birth-Rate, by O. E. Baker (pp. 138–146); A Study of the Interrelations of Farm, Home, and Community, by J. H. Kolb (pp. 177–179); Factors which Determine the Area and Structure of the Rural Community, by D. Sanderson (pp. 189–192); Looking Ahead in Rural Organization, by B. L. Hummel (pp. 193–197); A Report of a Study of Organizations Affecting Farm Youth in Three Areas in Pennsylvania, by W. V. Dennis (pp. 198–201); The Genesis to Farming Occupations in Connecticut, by J. L. Hypes (pp. 202–207); Rural Organizations and the Farm Family, by E. L. Kirkpatrick (pp. 208–210); Foreign-Born Farmers and Their Children, by E. deS. Brunner (p. 211); relationships and needs in rural sociology from the standpoints of research, by A. W. Drinkard, jr. (pp. 212–214); extension, by C. B. Smith (pp. 215, 216), and teaching, by A. R. Mann (pp. 217–220); Rural Government as a Field for Teaching, Extension, and Research, as Seen by a Rural Sociologist, by T. B. Manny (pp. 221–223), an Agricultural Economist, by B. H. Hibbard (pp. 224–227), and a Political Economist, by C. M. Kneier (pp. 228–231); My Philosophy of Rural Life, by H. C. Taylor (pp. 232, 233), E. V. O'Hara (pp. 233–235), L. Bane (pp. 235, 236), and C. J. Galpin

(pp. 286–288); and A Sociological Case Study of Farm Families, by D. Sanderson and R. G. Foster (pp. 266, 267).

The introduction to the section on rural sociology, by B. F. Coen (pp. 180–188), includes the reports of the several committees of the section.

[Papers on social changes] (*Amer. Jour. Sociol., 36 (1931), No. 6, pp. XVII+863–1066, figs. 7*).—This volume is the fourth of an annual series on social changes. The following papers pertain directly to rural conditions: Population, by P. K. Whelpton (pp. 865–879), and Rural Life, by B. L. Melvin (pp. 985–992). Other papers are included dealing with natural resources; inventions and discoveries; production; foreign policy; labor; earnings; employment, unemployment, and income of labor in the United States; social and labor legislation; medicine and public health; communication; community organization; the family; the child; the status of women; crime and penology; organized religion; race relations; education; and government.

A systematic source book in rural sociology, II, edited by P. A. Sorokin, C. C. Zimmerman, and C. J. Galpin (*Minneapolis: Univ. Minn. Press, 1931, vol. 2, pp. XIV+677*).—This, the second volume of the source book previously noted (E. S. R., 64, p. 577), deals with rural social organization in its institutional, functional, and cultural aspects. In presenting the material, "where the external traits of rural culture lend themselves to quantitative analysis, statistical data are presented to describe them. Where the figures either do not exist or do not adequately describe the situation, as is the case when the real significance of the phenomena is under discussion, the interpretation takes the form of a qualitative, nonstatistical description."

Chapters are included as follows: The family as the basic institution and familism as the fundamental relationship of rural social organization, dealing with the concept and functions of the family, specific traits of the rural family, factors in rural-urban differences in family morphology, organization, functions, and life history, familism as the fundamental trait of the social and political organization of agricultural societies, and individualistic atomism and extrafamilial associationism as dominant traits of the Gestalt of urban societies; rural economic organization, covering the internal organization of the family farm and the extrafamilial economic institutions before and after the development of money economy and urbanization; the organization of rural extrafamilial education, summarizing the evolution of rural extrafamilial educational agencies and elaborating on the main points; rural social control and comparative rural-urban criminality, immorality, and intemperance, dealing with the organization of rural social control and rural-urban criminality, immorality, and intemperance; rural religious organization, beliefs, attitudes, and culture, with sections on rural religious organization and rural magicoreligious beliefs and attitudes; rural aesthetic and recreational organization, behavior, and culture, presenting material on rural aesthetic and recreational organization, characteristics of agricultural aesthetic culture, other rural-urban differences, urbanization of the rural arts, and contributions of rural to urban art culture and making suggestions regarding the revival and development of true rural art; and rural political organization, parties, and behavior, with sections on the major political functions of peasants and farmers, rural political institutions and organization, and characteristics of rural political behavior.

AGRICULTURAL AND HOME ECONOMICS EDUCATION

Educational values in 4-H club work, E. H. Shinn (*U. S. Dept. Agr., Ext. Serv. Circ. 147 (1931), pp. 23, figs. 14*).—This mimeographed circular, the second in the series previously noted (E. S. R., 63, p. 691), is based on answers to a

questionnaire received from 206 members and former members of 4-H clubs in 30 States and data obtained by visits to different State and club camps. The charts present the information as to age of club members, length of membership, reasons for enrolling, social and economic results of membership, how income has been used, effect of club work on school work, criticisms of and suggestions regarding the improvement of club work and methods.

Motion pictures of the United States Department of Agriculture, 1931 (*U. S. Dept. Agr., Misc. Pub. 111 (1931), pp. II+26*).—This is a list of the educational motion picture films of the Department available for distribution, classified by subjects, with directions as to how such films may be purchased or obtained on loan.

FOODS—HUMAN NUTRITION

Food consumption of fifty Vermont farm households, M. MUSE and I. GILLUM (*Vermont Sta. Bul. 327 (1931), pp. 30, figs. 4*).—The data upon which this study is based were taken from 50 detailed household accounts kept during 1928 to 1930 by women in different sections of the State. Purchased foods were listed at prices actually paid and farm-supplied food was priced each month at the station according to the average current retail prices. The dietary scales used in analyzing the food consumption data were those tentatively adopted by the Bureau of Home Economics, U. S. D. A., pending revision of Technical Bulletin 8 (E. S. R., 58, p. 84). For children the standards for calories and protein were practically the same as recommended in this bulletin. "For calcium an allowance of a gram per day, regardless of age has been made; for phosphorus, the allowance for young children is practically that provided by a quart of milk, with a gradual increase with age until the adult allowance is reached by children of 12 years of age; for iron the allowance is 0.5 mg. per 100 calories up to the age of 12 or 13; thereafter the adult allowance is recommended." The data were compared for food cost, distribution, and adequacy with the Sherman standards.

The average total food cost for the year was $161 per adult male energy unit, or 45 cts. per day, of which 54 per cent was farm supplied and 46 per cent purchased. On the average 95 per cent of the milk, cream, and cheese and 21 per cent of butter and other fats came from the farm. A little less than 50 per cent of the meat, 22 per cent of the sugar and sirup, 81 per cent of potatoes, 78 per cent of other vegetables, and 64 per cent of the fruit were also supplied by the farm.

The average percentage distribution among the food groups was milk, cream, and cheese 23, butter and other fats 11, eggs 5, meat, poultry, and fish 17, vegetables and fruits 20, cereals and breadstuffs 10, sugar and sirup 6, and miscellaneous 7 per cent. These values were somewhat below the Sherman standards for milk and cereal products, above for meat, poultry, and fish, sugar and sirups, and vegetables and fruits, and corresponded closely with the standards for butter and other fats and for eggs.

The average figures for the food constituents considered most essential were protein 87, calcium 0.98, phosphorus 1.62, and iron 0.0174 gm. per adult male unit per day, with a total of 3,363 calories. These values were all above the customary standards, but when the individual diets were considered only 38 per cent were adequate in all respects. The energy and iron values were adequate in 54, phosphorus 72, protein 78, and calcium 80 per cent of the diets. A detailed study of the calcium relative to the milk supply in the diets showed that whenever a pint or more of milk per adult male calcium unit was used daily the calcium requirement was met.

A fairly close correlation seemed to exist between the cost and dietary adequacy per adult male energy unit per day. For the 19 diets considered adequate in all of the five factors studied, the average cost was 52 cts., for those adequate in four factors 46, in three 43, in two 40, in one 36, and for those inadequate in all five factors 31 cts. No diet costing under 40 cts. met all the standard requirements and only two inadequate diets cost as much as 50 cts.

The findings in this study are discussed in comparison with other similar studies, including a hitherto unpublished report of a study in Franklin County, Vermont, and studies from the Idaho (E. S. R., 63, p. 286), Ohio, (E. S. R., 64, p. 692), and Georgia (E. S. R., 63, p. 486) Experiment Stations. Attention is called to various sources of error in such studies, and it is concluded that "the comparisons of the average cost of 50 Vermont diets and their energy, protein, calcium, phosphorus, and iron intakes with similar averages secured in other studies is unsatisfactory, owing to differences in methods of collecting and analyzing data, as well as in the groups studied, the periods covered, and the methods of evaluating farm-supplied foods."

Boning lamb cuts, K. F. Warner (*U. S. Dept. Agr. Leaflet 74 (1931), pp. 8, figs. 12*).—Simple directions, with photographic illustrations, are given for boning the shoulder, leg, loin, and breast cuts of lamb, together with suggestions for cooking the various boned cuts. Boning is recommended because the boned cuts are easier to carve, have a more attractive appearance, and, if stuffed, go farther than unboned cuts.

Soft-curd milk, R. L. Hill (*Utah Sta. Bul. 227 (1931), pp. 24, figs. 15*).—This bulletin summarizes to date the author's studies on soft-curd milk which have been noted from time to time in progress reports (E. S. R., 63, p. 692) and in Bulletin 207 (E. S. R., 59, p. 790) which it supersedes. The apparatus and test for determining the curd tension of milk are described. Data are summarized on the curd tension of milk from Jersey, Holstein, Durham, grade, Guernsey, and Ayrshire cows, and various factors affecting the curd character of milk are discussed, particularly the effect of heat treatment and evaporation. Further data are reported substantiating the earlier conclusion that "from the standpoint of curd character evaporated milk is undoubtedly superior to market milk and compares favorably with raw soft-curd milk." Further case reports are given, showing the practical value of soft-curd milk in infant feeding. It is noted that such milk is now available in several cities, and that herd tests are being made preparatory to selling soft-curd milk in 35 different cities in 20 States.

The feathering of evaporated milk in hot coffee, R. Whitaker (*Jour. Dairy Sci., 14 (1931), No. 2, pp. 177–188*).—A study of the feathering of evaporated milk in hot coffee is reported, with the conclusion that the factors promoting feathering are unfavorable salt balance in the milk, particularly excess of calcium, extreme hardness of the water, too high a concentration of coffee, the use of too small a proportion of the milk, and the addition of the milk to the coffee rather than of the coffee to the milk.

An empirical feathering test was developed. This consisted first in determining whether or not the milk feathered when mixed with hot coffee according to a standardized procedure. If no feathering occurred the test was repeated with successive additions of N/2 calcium chloride until the amount required to produce feathering was determined. If, on the other hand, feathering occurred in the first test, the amount of N/2 sodium citrate required to prevent feathering was likewise determined. To distinguish between the calcium chloride units and the sodium citrate units, a minus sign (−) was prefixed to the former and a plus sign (+) to the latter.

An application of this test to the examination of 52 cans of commercial evaporated milk, representing 25 different brands purchased in stores in seven different cities throughout the United States, indicated that feathering in hot coffee is not a common defect of evaporated milk now offered to the public.

A similar study by Burgwald on factors influencing the feathering of sweet cream in coffee has been noted previously (E. S. R., 50, p. 852).

The copper content of various foods [trans. title], F. GRENDEL (*Pharm. Weekbl., 67 (1930), No. 36, pp. 913–921*).—The method followed in the analyses reported consisted in drying and ashing the sample, dissolving the ash in dilute nitric acid, evaporating it to dryness with sulfuric acid, extracting the residue with very dilute sulfuric acid, precipitating the copper by electrolysis, dissolving it in dilute nitric acid, and determining it colorimetrically by the method of Callan and Henderson.[4] Among the values given are potatoes 0.09 and 0.1 mg. per 100 gm., eggs 0.08 and 0.1, spinach 0.09 and 0.07, peeled banana 0.07, green cabbage 0.15 and 0.17, peeled oranges 0.12, 0.13, and 0.2, beefsteak 0.18, polished rice 0.22, and calf liver 0.48 and 0.54 mg. per 100 gm. Raw milk averaged 0.12 and pasteurized milk 0.22 mg., human milk 0.22 to 0.28, and goat's milk 0.15 mg. per liter.

Recent results in research on iron metabolism [trans. title], W. LINTZEL (*Ergeb. Physiol., 31 (1931), pp. 844–919*).—This literature review is presented under the headings resorption of iron, elimination of iron, intermediary iron metabolism, and the iron metabolism of the newly born. An extensive list of literature references is included.

Iron and copper in the treatment of anemia in children, M. S. LEWIS (*Jour. Amer. Med. Assoc., 96 (1931), No. 14, pp. 1135–1138, figs. 5*).—Observations are reported on the response to iron and copper treatment of 34 children suffering from secondary anemia. In all cases estimations of hemoglobin and red blood cells were made during a preliminary period of several weeks before the treatment was begun. Iron was then administered alone in the form of saccharated ferrous carbonate in amounts varying from 15 to 60 grains (0.1 to 0.4 gm.) daily. After from 2 to 4 weeks the iron treatment was supplemented with copper sulfate in 0.5 per cent solution in doses of from 1 to 2 teaspoonfuls three times a day. In the cases complicated by infection there was little improvement, but all of the subjects suffering from simple nutritional anemia uncomplicated by infections showed definite but slow improvement during the period of iron therapy and a much more rapid response to the combined iron and copper treatment. The earliest sign of improvement was an increase in appetite and general well-being and a gain in weight. The red blood cell counts rose quite rapidly and the hemoglobin more slowly.

Although it is admitted that definite conclusions as to the value of iron and copper in the treatment of anemia in children can not be drawn from such a small number of cases, the results are thought to confirm the conclusions of Waddell, Steenbock, and Hart (E. S. R., 62, p. 688) concerning the greater effectiveness of copper and iron than of iron alone in the treatment of nutritional anemia.

The fundamental food requirements for the growth of the rat.—VI, The influence of the food consumption and the efficiency quotient of the animal, L. S. PALMER and C. KENNEDY (*Jour. Biol. Chem., 90 (1931), No. 2, pp. 545–564, figs. 2*).—In this continuation of the series of studies noted previously (E. S. R., 61, p. 597), the authors first attempted by the paired feeding method to answer the question as to whether the better growth which they had observed in rats on a natural diet than on a synthetic diet (E. S. R., 58, p. 592)

[4] Analyst, 54 (1929), No. 644, pp. 650–653.

was due to a larger food consumption or to the ingestion of growth-promoting factors in the natural diet not present in the synthetic diet. In each pair the rat on the natural diet was allowed to eat only such an amount as to furnish the same amount of dry matter as that voluntarily consumed by its litter mate of the same sex on the synthetic diet. It was soon evident, however, that such comparisons would not be valid on account of the higher digestibility of the synthetic diet. Digestion coefficients of both diets were then determined and the paired feeding experiments continued on the basis of equal amounts of digestible dry matter. A total of 27 such comparisons, ranging in length from 5 to 25 weeks, was carried out. Numerical data are reported by sex for the first 12 weeks of the 20 experiments continuing for 12 or more weeks.

The mean gains for both males and females were higher on the natural than on the synthetic diets, and the animals were superior in physical appearance. Even more striking, however, was the great variation between different groups consuming the same kind and quantity of food during the same period of time. This was thought to be due to individual variations in food utilization. As a measure of these variations, the authors have adopted the term efficiency quotient, which represents the digestible dry matter consumed in grams per gram of gain in weight per 100 gm. of body weight and is calculated from the following formula:

$$\text{Efficiency quotient} = \frac{\dfrac{\text{Digestible dry matter consumed}}{\text{Gain in weight}}}{\text{Mean weight during experiment}} \times 100$$

The efficiency quotients of the animals in the experiments reported varied in the case of the males from −0.03 to +0.78 and of the females from +0.34 to +4.54. Such differences are thought to indicate that comparisons of the nutritive value of different diets are valid only when the paired animals have like efficiency quotients. To test this, the efficiency quotients of a group of young rats on a synthetic high protein, high fat diet containing vitamins A and D and supplemented with yeast were determined, and pairs of rats of the same sex and as nearly as possible the same efficiency quotient were used for a comparative study of yeast and an alcoholic wheat embryo as sources of water-soluble vitamins. In only one of the three tests was the yeast superior to the embryo extract. This and similar experiments with other food supplements have led the authors to infer that "the rate of gain in weight of animals having the same ability to utilize their food nutrients is governed more by the amount of food ingested than by its vitamin content."

A marked difference was found between the efficiency indexes of male and female rats. This difference is thought to be a major factor in determining the difference in growth rate of the two sexes.

In the final discussion, the authors emphasize that all of the experiments in the literature purporting to measure the effects of food upon growth are influenced by (1) the food intake and (2) the efficiency of food utilization. "It is impossible to know at present what their relative importance was in any given experiment. It is not improbable that many results that have been interpreted as measuring differences in the nutritive value of two foods or two diets were merely measures of the differences in the average efficiency of the animals employed."

Relation between nutrition of mother and birth weight of young, S. WAN and H. WU (*Chinese Jour. Physiol., 5 (1931), No. 1, pp. 53–70, figs. 3*).—As a part of the extensive investigation on the effects of vegetarian diets over several generations of rats (E. S. R., 62, p. 91), a statistical study was made of the relative birth weights of large numbers of rats on the vegetarian and stock diets, respectively, and of the effect of various factors on birth weight.

The data used as the basis for the study consisted of the birth weights of the young in 361 litters (covering seven generations) of vegetarian and 393 litters of omnivorous rats.

The omnivorous rats showed a seasonal variation in litter size, the mean number of young per litter in the summer being 9.79±0.12 and in the winter 8.81±0.15. No such difference was shown in the litter sizes of the rats reared on a strictly vegetarian diet, the means per litter for summer and winter being 7.72±0.10 and 8.09±0.09, respectively. Without reference to season, the mean difference in litter size between the stock and vegetarian rats was 1.33±0.11.

The birth weights of the young decreased with increasing size of the litters. For all litter sizes the average birth weight of the stock rats was 5.25±0.005 and of the vegetarian rats 4.80±0.007 gm. This difference could not be attributed to differences in the sex ratio of litters on the two diets.

The birth weights of the young increased with the age of the mother and the order of the litter up to the fourth for the vegetarian and the third for the stock rats. The differences in birth weights between the young of the stock rats and of the first generation of vegetarians, and between the young of the first and second generations of the vegetarians were statistically significant, but there was no significant difference between the second and subsequent generations.

The average birth weight of the young from stock mothers placed on the vegetarian diet at the age of 4 months was lower than that of the normal controls, and that of the young from vegetarian mothers placed on the normal diet at the age of 4 months higher than that of the vegetarian controls.

Growth of vegetarian rats on omnivorous diet, S. Wan and T. T. Chen (*Chinese Jour. Physiol., 5 (1931), No. 1, pp. 71–78, figs. 5*).—To determine the possibility of recovery of vegetarian rats from the malnutrition induced by this diet, five litters of newborn young of rats on the vegetarian diet were exchanged with stock young born on the same day. Most of the stock mothers refused to nurse the vegetarian young, but no such difficulty was encountered with the vegetarian mothers given the stock young. The one litter of vegetarian young nursed by the normal mother grew almost as well until weaning as the stock young, and when placed at weaning on the stock diet attained at 4 months 93 per cent of the average weight of normal rats. The normal young nursed by vegetarian mothers were markedly stunted. When weaned, part of these were kept on the vegetarian diet and the others placed on the stock diet. The latter showed marked acceleration of growth.

Vegetarian rats placed on the stock diet at the age of 4 months showed some acceleration of growth, but not nearly as marked as those placed on the stock diet at an earlier age.

The ability of the vegetarian rats to gain when placed on the stock diet is thought to exclude the possibility of any hereditary difference between the vegetarian and stock rats.

Malnutrition in children: An attempt at standardization of a dietary, L. C. Rosenberg (*Amer. Jour. Diseases Children, 41 (1931), No. 2, pp. 303–336, figs. 13*).—This paper reports in considerable detail a dietary experiment conducted for 6 months on 50 malnourished children in an orphanage. The children were divided into two groups carefully matched according to age, height, weight, and sex. One group received a special experimental dietary and the other one considered to be a representative American dietary. The progress of the children was followed by frequent height, weight, and other anthropometric measurements, physical capacity tests, urine, feces, and blood studies, and general health records.

The experimental dietary consisted of 1 qt. of certified milk daily, a variety of nuts, whole grain cereal products three times a day, fresh fruits and vegetables twice a day, and no meat or eggs. The control group received the same quantity of milk, although it was grade A instead of certified. Meat and eggs were given daily, vegetables and fruits once or occasionally twice a day, bread and cereals (but not of the whole grain) and no nuts.

During the 6 months the experimental group gained a total of 38.5 in. and the control group 31 in. in height. The average gains in weight were 7 lbs. for the experimental and 5.3 lbs. for the control group. More than half of the gain in weight in the experimental group took place in the first month of the experiment. The superiority of the experimental dietary was further demonstrated by the anthropometric data and, most particularly, by the general appearance of the children. No significant differences could be detected in the blood and bone examinations. The urines were of lower acidity in the experimental group and the feces of better appearance, with a diminution in the total number of bacteria. The nitrogen balances showed slighty better retention.

Feeding experiments with rats on composites of the two diets showed very little difference between the two with respect to general growth-promoting properties or content of vitamin B (B and G), both containing an abundance of this complex.

Factors involved in combating the "hunger strike" in children, W. P. Lucas and H. B. Pryor (*Amer. Jour. Diseases Children, 41 (1931), No. 2, pp. 249–261, figs. 9*).—A detailed study of 110 children suffering from anorexia, or refusal to eat, showed that 82 per cent belonged to the so-called linear type, from 0 to 10 per cent taller than the average for the age and from 7 to 30 per cent under the average weight for that height and age according to the Woodbury or Baldwin tables. There appeared to be a high correlation between obstinate constipation and poor nutrition, as judged by the Franzen method (E. S. R., 62, p. 687), in children of this type. Other characteristics were fatigue, irritability, poor muscle tone, and high basal metabolism.

Analyses of three-day diets of the children of this type who were suffering from anorexia showed them to be for the most part high in fat, sometimes containing over 50 per cent fat. As the first step in correcting diets of this type, the authors recommend eliminating the milk completely or greatly reducing it. In place of the accepted quart of milk a day, the necessity for which is regarded as having been "an obsession with these mothers," a quart of fruit juices is substituted. "Orange juice makes a good basis, and juice of berries and fresh or canned fruits may be added to make a pleasing variety of fruit punches which usually are taken eagerly by children." In general diets of low residue, low fat, and high vitamin content or of low fat, low starch, and high vitamin content are recommended, with insistence on abundance of rest. A few summarized case reports are given, showing the benefits accruing from the measures recommended.

Dried powdered milk preparations used in the feeding of infants: A bacteriologic study, J. Giblin and J. H. von Pourtales (*Amer. Jour. Diseases Children, 41 (1931), No. 5, pp. 1100–1103*).—Unopened cans of various milk preparations, including protein milks, carbohydrate modifiers, and reconstituted mixtures, were secured from the manufacturers and in the open market for bacteriological analysis, particularly for the distribution of *Bacillus tuberculosis* and various types of streptococci.

In the nearly 200 samples examined, there was no evidence of *B. tuberculosis*, and no hemolytic types of pathogenic streptococci were found. Occasionally short chains of streptococci were observed, but this variety was considered harmless. The possibility of confusing harmless *Streptococcus lacticus* with

the pathogenic *S. pyogenes* because of their identical cultural characteristics is noted. The two organisms may be differentiated by means of blood agar plates on which *S. lacticus* produces green or grayish colonies, with little or no hemolysis, and *S. pyogenes* small colonies surrounded by a large zone of hemolysis.

The authors conclude that to the extent that the samples tested represent present conditions in the manufacture of infant foods such foods are handled in as sanitary a manner as possible.

The influence of excessive milk feeding on gastric motility and its relation to chronic anorexia, W. J. Siemsen (*Amer. Jour. Diseases Children, 41 (1931), No. 2, pp. 291–302, figs. 7*).—The controversial literature concerning the value of extensive use of milk in the diet of children is reviewed briefly, and studies are reported on the gastric motility, as determined by the balloon method, in 11 children 8 years or more of age before and after a milk diet, which was continued as a rule from 7 to 10 days. Although the tracings showed great variability, not only in the different children but in the same child, it was concluded that the gastric motor activity was of about the same magnitude after as before the milk diet. It was admitted, however, that "possibly decreased motility was observed somewhat more frequently than was augmented motility after the milk diet." Definite decreases in appetite following the milk diet were not observed, and in some cases the appetite was thought to be improved.

Use of vitamin B in diets of infants, B. R. Hoobler (*Jour. Amer. Med. Assoc., 96 (1931), No. 9, pp. 675–677*).—Following a brief summary of studies on the symptomatology and pathology of vitamin B deficiency, a report is given of observations covering a period of 5 months and conducted on approximately 125 infants in the Florence Crittenden Hospital, Detroit, Mich., to determine the effect of vitamin B supplements on the growth in height and weight and the general condition of the children. Whole milk dilutions with dextrimaltose as the basic carbohydrate were used throughout the experiment as the basal ration. The vitamin B additions consisted of extracts of wheat germ and of brewers' yeast, added at the rate of 1 gm. of the former or 0.5 gm. of the latter to each ounce of the preparation of maltose and dextrin. The infants were kept on the basal ration for 2 weeks, at the end of which time some were given the vitamin additions while others remained as controls. The experiments were continued for a month after the supplements had been added. During the entire time weights were taken at weekly intervals and the total and stem lengths measured at the beginning and end of each period. Other observations included the degree of spasticity, percentage of hemoglobin in the blood, appetite, and bowel conditions. As further controls similar observations were made on breast-fed infants.

In growth as measured by stem length the infants receiving the dextrimaltose preparation with vitamin B additions made the best showing, followed by the breast-fed controls and those receiving the dextrimaltose preparation alone. In total length the best showing was made by the breast-fed infants, followed closely by those receiving vitamin B, while those receiving dextrimaltose preparation alone showed much poorer growth. The gains in weight were about the same in the three groups.

A further study of the relative merits of the two vitamin B preparations was conducted on 57 infants during a period of 2 weeks. Although the variations in gains were so slight that definite conclusions could not be drawn, the gains in decreasing order were breast-fed controls and those receiving the yeast extract, wheat germ, and the dextrimaltose preparation without vitamin addition. About 20 out of the 125 infants studied showed varying degrees of

spasticity or rigidity, 1 of these being a breast-fed infant. "It was evident that 10 of these 20 cases required more vitamin B than was contained in the additions supplied. It has been my experience that brewers' yeast concentrate or powdered yeast is a more effective way to supply the vitamin B complex."

Ultraviolet light in California summer sunshine, with special reference to its value in the prophylaxis and treatment of rickets, J. M. Frawley (*Amer. Jour. Diseases Children, 41 (1931), No. 4, pp. 751–757, fig. 1*).—Measurements of the ultra-violet radiation in the sunlight were made at three different localities in California which were at about the same latitude but varied widely in climatic conditons. The measurements were made by the acetone-methylene blue method modified slightly to make allowance for the fading through ordinary glass, the exposures being limited to 4 hours, from 10 a. m. to 2 p. m., during sunny days in the summer.

In terms of units of fading, each representing from two to four times the erythema dose, the values obtained were for the Sierra Nevada Mountains (elevation 8,000 ft.) 8, Santa Barbara on the coast 5, and Fresno in the interior of the State 3. The low value at Fresno, where there is an unusual amount of sunshine, is attributed to the haze which customarily hangs over the valley. On account of the intense summer heat in this section of the State, it is impossible to expose children to sunshine or skyshine during the middle of the day and consequently a mild degree of rickets commonly prevails among the children who are not given cod-liver oil or artificial light during the summer months. "This anomalous condition prevails throughout the great central portion of California which is usually called 'the garden of the sun.'"

Excessive ultraviolet irradiation: Effect on the nutrition and the endocrine glands of rats, A. F. Hess and P. E. Smith (*Amer. Jour. Diseases Children, 41 (1931), No. 4, pp. 775–782, figs. 4*).—Prolonged irradiation with the mercury vapor lamp even at high intensity and the administration of viosterol in excessive as well as small amounts were found to have no effect upon the growth of rats on a stock diet considered adequate in every respect. No difference was noted at necropsy between the endocrine glands of the treated and untreated rats. These observations are of interest in view of the increasing use of ultra-violet therapy for various pathological conditions not associated with definite disturbances in the metabolism of calcium or phosphorus.

Effect of elementary phosphorus in rickets, A. F. Hess (*Amer. Jour. Diseases Children, 41 (1931), No. 5, pp. 1081–1085, fig. 1*).—This paper consists chiefly of a discussion of previously noted papers by Compere (E. S. R., 64, p. 596). In the author's opinion elementary phosphorus is of value in the treatment of the premature baby with rickets and in the porotic form of rickets which resembles atrophy of the bones. It may be serviceable as a supplement to cod-liver oil in the cure of osteomalacia, but is of no value in prophylaxis against rickets or in the cure of ordinary rickets because it exerts no action on the calcification of the proliferating cartilage.

"If one wishes to fortify cod-liver oil, it is far more reasonable and efficacious to increase its potency by adding a small amount of viosterol, which is a specific in the prevention and cure of rickets, as it brings about calcification not only of the bone but of the proliferating cartilage as well.

Metabolism of obesity.—VIII, Basal metabolism and insensible perspiration during a period of reducing weight, C. C. Wang, S. Strouse, and M. Andersoh (*Arch. Int. Med., 46 (1930), No. 6, pp. 1002–1013*).—This continuation of the series of papers noted previously (E. S. R., 64, p. 598) reports a total of 190 metabolic tests conducted during a period of dietary reduction of weight on three obese women, one of whom had diabetes. The daily metabolism of all three subjects fluctuated considerably, varying from 1,751 to 1,163 calories,

from 1,876 to 1,392, and from 1,880 to 1,616 calories per 24 hours. The weekly averages showed a gradual decrease in heat production with decrease in weight. In comparison with normal standards using the actual weights of the subjects, the basal metabolic rates were 9.3, 6.3, and 6 per cent, respectively, below the DuBois standards and 7.7, 3.2, and 7.4 per cent, respectively, below the Benedict standards. When the ideal rather than the actual weights were used in the calculations, the values were higher than the standards and tended to decrease with the reduction of body weight.

The influence of reduction in weight on the respiratory quotient and on the pulse rate varied with the subjects. Determinations of the insensible perspiration on two of the subjects showed marked fluctuations, but no definite relationship to the basal metabolic data could be detected.

TEXTILES AND CLOTHING

A method for determining the thickness of pile and napped fabrics, M. B. Hays (*Jour. Home Econ., 23 (1931), No. 6, pp. 560–564, fig. 1*).—This paper, which should be consulted in the original, describes a satisfactory optical method which has been developed at the Bureau of Home Economics, U. S. D. A., for measuring the thickness of piled or napped fabrics, and discusses its accuracy in comparison with other methods reported in the literature.

The breaking and bursting strength of some weighted and unweighted silk fabrics after exposure to light, M. E. Griffith (*Ohio Sta. Bimo. Bul. 151 (1931), pp. 145–148, figs. 4*).—Five pure dye and 5 weighted fabrics, all mulberry silks of plain weave and crepe construction, were exposed to the violet carbon arc light for 6, 12, 24, and 48 hours, and the breaking and bursting strengths after each exposure were determined on dry and wet samples.

Less change occurred in the strength of the unweighted than in that of the weighted silks, and there was less change in bursting than in breaking strength of both weighted and unweighted fabrics. The change in bursting and breaking strengths was quite similar in both types of silks after 6 hours' exposure, although greater differences were noted after longer periods of exposure.

The infant skin and infants' underwear (*Arch. Ped., 48 (1931), No. 6, pp. 392–409, figs. 16*).—This is a general report of an investigation, sponsored by a manufacturer of infant underwear, to determine what materials and types of underwear are best for infants' wear. The investigation included microscopic studies of the materials commonly used and the analysis of a large number of questionnaires sent to leading pediatricians and other physicians, hospital technicians, and nurses to determine their theories and practices in regard to recommendations for infants' underwear.

Concerning the first phase of the investigation, no data are given beyond a few microphotographs of silk and wool fabrics and mixed cotton fabrics, the latter selected particularly to show various impurities likely to cause irritation in some of the inferior cotton and mixed fabrics. The questionnaire is given in full with summaries of the replies. Of 557 replies to the question of preferences of material, 275 favored silk and wool, 231 all cotton, 98 wool and cotton, 26 silk, wool, and cotton, and 20 silk and cotton, with linen, silk, and cotton and linen making up the rest. Other questions included clinical experience with regard to the effect of different types and weights of underwear and choice of styles for various undergarments.

Slip covers, B. M. Viemont (*U. S. Dept. Agr. Leaflet 76 (1931), pp. 8, figs. 7*).—This leaflet lists various uses of furniture slip covers, gives advice on the selection of materials to harmonize with the other furnishings in a room, and gives directions for estimating the amount of material required for such covers and for making the covers.

HOME MANAGEMENT AND EQUIPMENT

Thermal efficiency of surface units in electric ranges, VEN. W. SWARTZ (*Jour. Home Econ., 23 (1931), No. 5, pp. 459–464*).—This contribution from the Washington Experiment Station reports a comparison of the speed and thermal efficiency of the surface units on five electric stoves, including open, closed, and special combination units. The method consisted in placing a pan containing 1,000 gm. of water or corn oil on the cold unit, turning the current on to high until the liquid reached the boiling point, and then shutting the current off, watching the rate of cooling for one-half hour, and finally weighing the pan and contents. Temperatures were taken with a thermocouple and potentiometer at 5-minute intervals in the case of water and at 2-minute intervals with the oil during the heating and cooling. Power consumption was measured with a special watt-hour meter. The efficiency was calculated by dividing the work accomplished by the effort expended, the former being measured by the rise in temperature of pan and contents and the amount of evaporation and the latter by the heat equivalent of the power consumed, calculated as the number of watt seconds used divided by the factor 4.18. The following conclusions are drawn:

"Open units are, in general, faster and more efficient than closed units of the same wattage. Special units of larger wattage, but of the same diameter, may be expected to be faster than the standards units, but no more efficient. Water will continue to boil, and food to cook, on a unit from 17 to 22 minutes after the current is turned off. This heat must be utilized if electric cooking is to be economical."

Fuel economy of triplicate pans, VEN. W. SWARTZ and G. JONES (*Jour. Home Econ., 23 (1931), No. 5, pp. 467–470*).—Following the same general method as in the study noted above, the authors compared the efficiency of triplicate triangular saucepans used singly and combined with that of a round kettle of the same capacity as a single one of the triplicate kettles. Three heating units were used, 5½, 8, and 8½ in. in diameter and of 1,000, 1,500, and 1,500 watt strength, respectively.

It is concluded that "if three foods are to be prepared simultaneously on the surface units of an electric range, they can be cooked most economically in a set of triplicate saucepans, all used over one unit. The unit chosen may be a large one if speed is desired, or a small one if slightly greater efficiency is preferred. Compared to using three pans of the usual round shape, the triplicate set offers a decided saving of fuel, about 27 per cent. But if one pan is to be used alone, the single round pan gives far better results than does one of the triplicate set, being superior both in speed and in efficiency. To use one of the triplicate set on a unit of larger wattage is a further waste of time and fuel."

It is again emphasized that if electric cooking is to become really practical and economical, the habit should be developed of turning off the current for 20 or 30 minutes before the food is completely cooked.

Speed and efficiency of oven utensils, B. CORNEHL and VEN. W. SWARTZ (*Jour. Home Econ., 23 (1931), No. 5, pp. 464–467*).—Essentially noted from other sources (E. S. R., 64, p. 691).

MISCELLANEOUS

Michigan Agricultural Experiment Station Quarterly Bulletin, [May, 1931], edited by V. R. GARDNER and A. J. PATCH (*Michigan Sta. Quart. Bul., 13 (1931), No. 4, pp. 181–234, figs. 11*).—In addition to articles abstracted elsewhere in this issue, or previously from other sources, this number contains the following: Selecting the Electric Motor for Pumping Water, by W. H. Sheldon (pp. 190–194), and The Cherry Case-Bearer, *Coleophora pruniella* Clemens, in Michigan, by R. Hutson (p. 223).

NOTES

Kansas College and Station.—H. H. Laude, associate professor of agronomy and in charge of cooperative experiments, has been appointed professor of agronomy and given charge of experimental work with farm crops vice S. C. Salmon, resigned, and will be succeeded in charge of cooperative experimental work by A. L. Clapp, associate agronomist in extension. Sabbatical leave for the ensuing year has been granted to H. W. Cave, professor of dairy husbandry; W. F. Pickett, Earl B. Working, C. E. Aubel, and A. C. Fay, associate professors of horticulture, milling industry, animal husbandry, and bacteriology; J. A. Hodges, assistant professor of agricultural economics; and Ruth Tucker, instructor in food economics and nutrition.

Mississippi College and Station.—On September 1 J. B. Edmond succeeded H. B. White as associate professor of horticulture and associate horticulturist. Otis B. Casanova has been appointed assistant director in charge of the Holly Springs Substation, succeeding T. F. McGehee.

Missouri University and Station.—A notable gift to the station recently announced consists of 50 cows and 2 bulls from the purebred Holstein herd of F. W. A. Vesper of St. Louis. Thirty of these cows were in milk, many of them on Advanced Registry test milking four times daily, so that this addition to the station herd has practically doubled the daily milk production.

M. F. Miller, assistant dean of the College of Agriculture and chairman of the department of soils, has been designated acting dean and director during the six months' absence in Europe of Dr. F. B. Mumford for a study, mainly in England, France, and Germany, of world conditions affecting American agriculture and the plans of various Governments for the advance of agricultural interests through agricultural education and research and along economic lines.

Montana College and Station.—A creditable sheep station is being developed from the old frame buildings at historic Fort Ellis near Bozeman. A new horse barn has been completed, and a residence and a large sheep shed are being constructed. Electricity is now available, and a complete water system is being installed. The small band of sheep will be increased in number this fall.

Director F. B. Linfield has been granted leave of absence for four months to be spent in the Orient and ending in December. Japan, China, India, Australia, New Zealand, and the Fiji and Hawaiian Islands will be visited, and a report will be presented on the agricultural outlook in Australia and New Zealand, with particular attention to grain and dairy production. During his absence, Clyde McKee, who returned to the institution June 1 after a year of travel and graduate study, will serve as acting director. Arthur H. Post, associate professor of agronomy and acting agronomist during the past year has been granted sabbatical leave for graduate study at the University of Wisconsin.

Dr. W. E. Joseph, associate animal husbandman in charge of sheep investigations, has resigned effective September 1. W. F. Dickson has been appointed assistant animal husbandman effective August 15, and will have charge of beef cattle and swine investigations at the home station and all livestock investigations at the substations. Frank Barnum has been appointed assistant in animal husbandry for sheep investigations. Dorothy Douglass, assistant in home economics research, resigned effective July 1, and was succeeded by Helen Lewis Mayfield.

Crop rotation experiments have proved very definitely the effectiveness of rotation in the control of perennial weeds, such as Canada thistle. Four-year rotations including one year of red clover or six-year sequences which use three years of alfalfa have kept Canada thistles under complete control, whereas they have become serious under continuous cropping or in short-time rotations of grain crops.

Fertilizer experiments in Bitter Root Valley orchards continue to emphasize the importance of phosphate fertilizer in the production of apples. Data obtained by the department of horticulture show that not only do phosphate treated trees hold their fruit better than do untreated trees but also that the fruit has a better color.

Nebraska University and Station.—Because of the general financial depression, reductions were made by the last legislature in the appropriations for most of the expending agencies of the State. The direct tax appropriation for the university was reduced approximately 5 per cent as compared with two years ago, and of this amount the station assumed approximately 4 per cent of its direct tax appropriation. The revolving funds made up of cash receipts have also been reduced by the lower prices received for farm products. Provision was made, however, for some building, the College of Agriculture being alloted $15,000 for cottages for the North Platte Substation and $75,000 for rebuilding the animal husbandry building, partially destroyed by fire during the spring, while a special appropriation of $20,000 was made for a shop building at the Curtis School of Agriculture.

New York State Station.—Primarily as an aid to the seed inspection, studies are to be begun of the factors affecting the germination of seeds, particularly light, heat, moisture, maturity of the seed, and storage conditions. Special funds to carry on these studies were appropriated by the last legislature, and Drs. Arthur L. Shuck of the University of Illinois and Mabel R. Nebel have been appointed, respectively, associate and assistant in research (botany) to carry them on.

Other appointments include the following, effective about July 1: Dr. Maurice W. Yale and Alvin W. Hofer as associate and assistant in research (bacteriology); Dr. H. S. Cunningham, associate in research (plant pathology) vice Dr. E. E. Clayton, whose resignation has been previously noted; L. M. Cooley, formerly plant pathologist at the Ohio Station, associate in research (plant pathology) for the investigation of diseases of small fruits; and E. C. Smith, assistant in research (chemistry).

Morgan P. Sweeney, associate chemist and a member of the station staff for 22 years, died August 6 following a brief illness and has been succeeded by Harold G. Beattie.

Ohio Station.—Dr. George A. Filinger, assistant entomologist, has resigned to become assistant professor of pomology in the Kansas College. T. S. Sutton has been appointed assistant in dairying, with headquarters at Columbus, and C. A. Lamb, assistant in cereal breeding.

Oregon College and Station.—Dr. A. B. Cordley, connected with the institution for 36 years, dean of the school of agriculture for 23 years and director of the station from 1914 to 1920, has been appointed dean emeritus.

Following the resignation of Director James T. Jardine to become chief of the Office of Experiment Stations on September 16, William A. Schoenfeld, regional representative of the Federal Farm Board at Portland, Oreg., has been appointed dean and director.

Pennsylvania College and Station.—L. V. Kline, instructor in forestry, resigned effective June 30. Arthur W. Clyde, associate professor of agricultural engineering at the Iowa College, has been appointed associate professor of agricultural engineering beginning July 1.

Rhode Island Station.—Effective September 1, Homer O. Stuart has been appointed head of the department of poultry husbandry, formerly the department of animal breeding and pathology. On the same date, Harold C. Knoblauch was appointed assistant agronomist.

South Dakota College.—The last legislature made an appropriation for enlarging the engineering building by raising the roof one story and inclosing a court at the rear, thereby furnishing much additional room. Appropriation was also made for an addition and repairs for the college power plant.

Virginia College and Station.—C. H. Hamilton, assistant rural sociologist, resigned September 1 to accept a position at the North Carolina Station and has been succeeded by A. C. Seymour. Robert A. Polson, acting assistant rural sociologist for the past year, accepted a position on the same date in the rural sociology department of Cornell University.

J. F. Eheart, assistant chemist, has been granted leave of absence for a year's graduate study at Pennsylvania State College, beginning October 1, and H. G. Cunningham, jr., has been appointed acting assistant chemist during his absence.

Wisconsin University and Station.—Dr. Alvin R. Lamb has accepted a position as biochemist in the U. S. Public Health Service and has been assigned to the Leprosy Investigation Station at Honolulu.

Swedish Central Agricultural Experiment Station.—A recent summary in English of the work of this institution (E. S. R., 65, p. 198) has made more readily available considerable information regarding its activities.

The station was organized in 1907, taking over a tract of land just outside of Stockholm which had been used for agricultural experiments by the Royal Academy of Agriculture since 1816, the work carried on by the academy in agronomy, agricultural chemistry, and plant physiology, an experimental institute managed by the Board of Agriculture, and an organization for local field experiments of the county agricultural societies. There were immediately added departments of animal husbandry and dairying, and in 1912 a department of agricultural bacteriology. Subsequently a number of control and miscellaneous duties were prescribed, among them a State Potato Inspectorate handling both exports and imports, a plant import control, and agencies for pig-breeding pedigree work, beekeeping diseases, and a certain amount of control over the privately administered experimental work, such as that of the various research associations which is aided by Government funds. The station is supported entirely by the Government and operated by a board chosen in part by the Crown and in part by the academy.

The station maintains several laboratories, an experimental farm of 44.5 acres at Experimentalfältet, facilities for dairy experiments at Stockholm, and a large amount of cooperative work with plants and animals in different parts of the country. There are 16 permanent fields attached to agricultural schools, many fields located on private farms, and an experimental farm established in 1928 at Lanna in the county of Skaraborg. A decision was reached in 1930 to establish a second farm at Offer in the county of Västernoorland.

The station has published 378 bulletins, 149 circulars, and many miscellaneous articles.

EXPERIMENT STATION RECORD

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EDITORIAL

JAMES T. JARDINE, FIFTH CHIEF OF THE OFFICE OF EXPERIMENT STATIONS

On September 16, 1931, Director James T. Jardine of the Oregon Experiment Station became chief of the Office of Experiment Stations and assistant director of scientific work of the Federal Department of Agriculture. His appointment terminated a vacancy which had existed in these offices since the death of Dr. E. W. Allen on November 11, 1929. During the interim, the administrative direction of the Office had devolved upon Dr. W. H. Evans as acting chief. This responsibility was carried by Dr. Evans in addition to his usual duties as chief of the division of insular stations, the principal readjustment being the transfer during this period of his *Record* abstracting in agricultural botany and plant diseases to Mr. J. W. Wellington of the sections of horticulture and forestry. Under these arrangements the work of the Office was conducted for nearly two years with a minimum of interruption and delay and a maximum of consistent effort to maintain as closely as possible the established policies of former years.

The new chief of the Office is the fifth incumbent of the position since the creation of the Office of Experiment Stations in 1888 under the leadership of Dr. W. O. Atwater, and he is the first of Dr. Atwater's successors without previous service on its staff. He is, however, unusually well acquainted with both the Department and the State experiment stations. A graduate of the Utah State Agricultural College in 1905, he became a special agent for the Forest Service in 1907 and served as forest supervisor from 1908 to 1910 and as inspector of grazing in charge of the national forest range investigations and range surveys from 1910 to 1920, when he accepted the directorship of the Oregon Experiment Station.

The period of his leadership in Oregon was one of steady development and growth. When he became director the station staff numbered 56, of whom 38 were also engaged in teaching and 12 in extension work. A decade later 43 of its 79 members were engaged exclusively in station work. The total revenues rose from $164,900 in 1920 to $408,439 in 1930. The scope of the station's investigations was greatly broadened and its influence widely extended.

This first-hand experience in station administration has been supplemented by exceptional opportunities to study the experiment station enterprise as a whole. Mr. Jardine has been active in the Association of Land-Grant Colleges and Universities, serving on its standing committee of experiment station organization and policy since 1924 and as its chairman since 1927, a period in which an unusual number of important problems have been under consideration. A further unique opportunity for close contacts came with the recent survey of the land-grant colleges and universities by the U. S. Office of Education, when he headed a group of 10 station directors which interpreted the data collected on the status of agricultural research in these institutions and devoted himself for several months to the preparation of the comprehensive report on this subject reviewed in these columns last April (E. S. R., 64, p. 401). In this way he acquired an intimate knowledge of the experiment stations, both individually and as a group, which should be of much advantage in future relationships.

A new leadership, such as has now become effective, inevitably suggests possible changes in policy. This is particularly to be expected in the case of an organization like the Office of Experiment Stations, which has traditionally developed close personal relationships with the institutions with which it deals. This attitude has been aptly characterized by the Institute for Government Research in its monograph in 1924 as "a unique example of national administration," in which "influence rather than coercion is the policy." A similar view is expressed in the report of the land-grant college survey, in which it is emphasized that "the policy of the Office of Experiment Stations from the first has been publicly announced as 'one of participation rather than control.'"

Announcement is authorized by Mr. Jardine that no change in this fundamental policy is contemplated. It is hoped that, to the limits of its resources, the activities of the Office may continue to be so directed as to promote as effectively as possible the cause of agricultural research and the interests of the stations. It will be the aim to give these institutions all assistance in its power in organizing their work and in developing it to the point of maximum service to the agriculture of the Nation.

THE AGRICULTURAL EXPERIMENT STATIONS IN 1930

A comprehensive view of the experiment station system as it exists to-day is afforded by the report on this subject just issued by the Office of Experiment Stations. Compiled to cover the fiscal year ended June 30, 1930, this report, like those of previous years, reviews

the work and expenditures of the agricultural experiment stations in the several States and in Alaska, Hawaii, Porto Rico, Guam, and the Virgin Islands. It recapitulates the major developments of the period, assembles much statistical and other information, and presents considerable discussion of questions of organization and policy. The progress in all lines of station work is noted, but particular attention is given to the investigations in agricultural economics, rural sociology, home economics, and agricultural engineering during the five years since the passage of the Purnell Act.

The fiscal year 1930 brought the Purnell allotments to their maximum of $60,000 per annum to each State, so that the total Federal aid to the stations during that year of $4,582,000 represents the high-water mark of direct Federal contributions under existing legislation. The aggregate income of the stations was likewise larger than ever before, and it is significant that approximately 75 per cent of the total of $17,911,123 was derived from State sources. Sales receipts showed a decrease from $1,996,470 to $1,855,356 for the year, presumably in part because of the lower prices of farm products, but the State appropriations and allotments increased from $8,120,801 to $8,807,105.

This gratifying indication of the sustained interest and liberal support by the States themselves is further attested by a consideration of available funds during the five-year period since 1925. Not only did the total revenues increase by $7,329,147, or nearly 70 per cent, but no less than $2,979,233 of this amount came from enlarged State appropriations and allotments. Some unevenness of distribution is to be noted, four States showing a shrinkage of income from sources within their borders, but the total of these decreases was only $65,260 and is relatively insignificant as compared with the pronounced tendency in most States to continue and augment their support of research even under the handicap of serious economic depression.

That the enlarged resources of the stations were effectively utilized seems evident by the marked increase in personnel, projects, and publications. In 1925 the stations' staffs aggregated 2,415, of whom 1,265 also had teaching duties and 347 engaged in extension work. In 1930 the total was 3,254, of whom 1,473 and 509 were also teachers or extension workers. The net gain to the stations in this respect is therefore considerable.

On the basis of receipts by this Office, the publications in the regular station series numbered 585 in 1925 and 881 in 1930. In addition, 30 articles were contributed to the *Journal of Agricultural Research* and 1,305 to other scientific and technical journals in 1925, while in 1930, 64 articles were published in the *Journal of Agricultural Re-*

search and 1,358 by other journals. Nor was this gain merely quantitative. The 1930 report states that "the publications of the experiment stations show from year to year increasing evidence of care in preparation. Competent editorial assistance is being given a larger and more influential place in station organization, and there is a tendency toward closer coordination of all informational activities of the institutions with which the stations are associated, having as its object better dissemination and use of the results of station work."

The number of active projects under way in the stations rose from 5,688 in 1925 to over 7,000. Their wide scope and variety is shown by the following classification: Field crops 1,864, horticulture 1,224, animal husbandry 1,015, plant pathology 575, economic entomology 525, soils and fertilizers 519, agricultural economics 463, agricultural engineering 312, veterinary science 284, genetics 189, home economics 158, dairying 145, and forestry 138, with smaller numbers in various other subjects. Of these, 485 were Adams Act projects, while 1,336 were supported as a whole or in part by Purnell funds. Approximately $1,180,000, or nearly half of the Purnell fund, was used for the support of investigations in agricultural economics, rural sociology, and home economics. This situation was substantially as in former years, for the $9,600,000 made available by the Purnell Act since its passage, $3,113,000 has been used for investigations in agricultural economics, $401,000 for rural sociology, and $1,194,000 for home economics, or a total of $4,708,000 for these three subjects.

Concerning the research as a whole the report points out that "most of the work of the stations is now conducted on the basis of carefully considered and formulated projects. Especially is this true of the work supported by the Adams and Purnell funds. The tendency is to make the projects more specific as to purpose and plan, in accord with high standards of scientific research."

Still another indicator of ultimate progress may be found in the additions which are provided in the facilities for research. Here again the record is such as betokens, on the whole, considerable effort to keep pace with the steadily expanding activities. During 1930 the stations expended $1,252,390 for buildings, $65,084 for library purposes, $222,394 for apparatus, $307,645 for farm implements, $145,132 for livestock, and $296,754 for miscellaneous items. This makes a total of $2,289,399 for additions to general equipment, an increase of $225,516 over the previous year and $814,198 more than in 1925.

In one respect, however, the showing is deemed still disappointing. Although the library allotment is nearly double the $35,379 expended in 1925, it represented only 0.36 per cent of the funds available for

station support. This provision is regarded as inadequate, and the report of the survey of land-grant colleges and universities is cited in support of this contention. It is maintained that "the field of scientific research and the volume of scientific literature have grown so large and are increasing so rapidly that despite the existence of many helpful abstract journals and other bibliographical aids an individual investigator can hardly hope to keep fully informed as to the progress of science even in a limited field without competent library and bibliographical assistance." The suggestion is advanced that the "inadequate library service may be due in part to failure of the investigator as well as the administrator to appreciate fully the research value of such service."

Comment on most other aspects of the station work is much more favorable. Particularly is this true of the important matter of cooperation, for which a considerable gain is reported. According to the records of the Office at the end of the fiscal year 1930, 1,176 of the 7,000 active station projects involved cooperation either between the stations or with one or more bureaus of the Department, and somewhat over 200 new cooperative projects were put into effect during the year. All the experiment stations and the bureaus of the Department have taken some part in this cooperative work, the cooperative activities of the Department being confined largely to matters of national or at least regional importance, whereas the experiment stations are usually concerned mainly with such features of the undertakings as affect local agriculture. The broad viewpoint of the Department, its wide knowledge of research in the subjects under study, and its large resources and research facilities often make it eminently worth while for the stations to cooperate with it on problems of mutual interest. On the other hand, the results of regional and national studies appear to be most useful to agriculture on a large scale if they represent the aggregate of the best information obtainable from the local sources. The ability of the stations to supply this information makes cooperative research as valuable to the Department as it is to the stations.

Reference is made to efforts during the year to establish a uniform procedure in arranging for cooperation between the Department bureaus and the experiment stations, which permits preliminary and informal planning of the work by representatives of the bureau and the experiment station, but requires approval of the terms of agreement by the experiment station director and the bureau chief concerned and the Director of Scientific Work of the Department. In case of cooperative projects supported by Adams and Purnell funds, approval by the Office of Experiment Stations is also required. "Adherence to such a procedure, it is believed, would result in better

cooperative relationships and in greater economy and efficiency in the use of research funds."

The ultimate measure of success in a research enterprise is the value of its results, and the report appropriately devotes most of its space to a presentation of some of the more important findings of the year. A goodly showing is made for most of the various fields, but under present conditions special interest attaches to what has been accomplished in agricultural economics and rural sociology. The report discusses this point in part as follows: "Although no method has yet been devised whereby social progress can be measured with precision, . . . comparing the present with five years ago, progress will be noted in the number, training, and experience of the personnel; in the number and character of projects undertaken; in cooperative relations existing among specialists within particular station organizations, among stations in the same agricultural region, and between State stations and Federal bureaus; in the correlation of rural social with natural science research projects; in the degree of completeness of the research programs developed; and in the significance of published results. . . . The general tendency has been to fill in the gaps and round out the programs of economic and sociological research so that the body of information thus created may be more complete. Though much remains to be accomplished in matters of selecting problems for study, refining research methods, interpreting results, and perfecting the style of presentation in publications, it must be admitted that, everything considered, both agricultural economic and rural sociological research in the United States have really made remarkable advancement in the relatively short period of their existence." This is deemed fortunate, for "with the productive powers of farmers becoming more and more effective, and with American agriculture tending more and more toward commercial objectives, greater emphasis is being placed upon the importance of better incomes for the farmer and his family and better standards and higher planes of rural living." This means that "instead of depending upon empirical methods such as have characterized the greater part of our national experience, research in agricultural economics and rural sociology will hereafter be looked to for the information needed in efforts to assure rural advancement."

The substantial progress in home economics research since the Purnell Act became effective is indicated by the fact that whereas previously Federal financial support was being given the home economics departments of land-grant institutions in only 4 States, in 1930 this type of research was under way in 44 States and Hawaii, and in at least 3 of the 4 remaining States projects having a direct bearing upon foods and human nutrition were being carried on by other departments. This expansion is the more remarkable in view

of the serious problems as to the organization and administration of home economics research which were encountered in many States and the sudden demand for a relatively large number of adequately trained home economics workers. In spite of these difficulties, a commendable record was made. The report points out that, as regards training, the fact that almost 90 per cent of the project leaders and assistants have had some graduate work and 32 per cent have had the experience in original research required for the degree of doctor of philosophy indicates standards comparing very favorably with those of the longer established experiment station divisions.

A disproportionate number of projects in foods and nutrition is noted, but it is made clear that this "may not represent a correspondingly large proportion of time or funds, since research in foods lends itself to definite, small, clear-cut projects as compared with some of the broad and general topics under family economics and the long-time projects in equipment." Many in the latter group have been found to require cooperative attack, and it is concluded that while notable advance has been made in interdepartmental cooperation in various lines of home economics research, perhaps one of the most important effects of the establishment on a substantial scale of such research at the experiment stations has been the interest awakened in coordinating family economics with farm economics and home engineering with agricultural engineering.

Likewise in agricultural engineering has the Purnell Act been influential in enlarging and improving the work of the stations, giving it a better status in the station research program and increasing the output of information useful in agricultural practice. An increase of 70 per cent in the number of projects, a substantial enlargement of funds, and a gain in the number of publications from 107 in the period 1920–1925 to 183 in 1926–1930 are among the tangible results which are recorded. "The most important and profound influence of the act on agricultural engineering research appears, however, to have been the stimulation of investigations of more fundamental character."

The report deals primarily with the work of the experiment stations themselves, and little is therefore said as to the influence of the Office itself upon these institutions and what they have accomplished. For obvious reasons the columns of the *Record* are also unsuitable for such an evaluation. The view may be expressed, however, that the contribution of the Office as the representative of the Department in the administration of the Federal funds, in an advisory capacity, and as a central clearing house of information have been appreciable and appreciated. The era of new leadership which is now beginning should bring additional opportunities for service in all of these directions.

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

[Investigations in agricultural chemistry at the California Station] (*California Sta. Rpt. 1930, pp. 33, 34, 81, 82, 104, 105–107*).—The work on alkali reclamation and on the base exchange complex has had in general the purpose and result of confirming the conclusions noted in detail from last year's report (E. S. R., 62, p. 716). "X-ray examination of bentonites and soil colloids indicates that they are related. This is true of the original unground samples and the portions which have been ground for varying lengths of time. The X-ray examination of the material shows that the inorganic base exchange substances composing the colloidal fraction of the soils examined are crystalline substances. These chemical and X-ray data indicate that the inorganic base exchange substances are not zeolites."

In addition to this work it is noted that "considerable study has been given to the Denigès colorimetric method for the determination of phosphorus. Much of this work has confirmed the findings of other investigators, while certain other important points have been revealed. Under conditions of low acidity, ammonium molybdate will form a compound with silica, which when reduced will give the same blue compound as does phosphorus. This compound forms almost instantaneously and persists even after the acidity has been increased to the proper strength for the phosphorus determination. Under favorable conditions less than 0.1 part per million SiO_2 will give an appreciable blue color, hence it is very important that the reagents used in the test for phosphorus be combined in such a manner as to prevent the formation of this compound. If the unknown solution to be tested for phosphorus is slowly added to the proper quantity of a 2.5 per cent solution of ammonium molybdate in 0.10 N H_2SO_4, as much as 500 parts per million SiO_2 can be present in the final solution without giving enough color to introduce an appreciable error in the phosphorus determination."

In plant nutrition studies, "the evidence is clear that with such crops as tomatoes and barley it is possible, under suitable conditions, to obtain a highly consistent reflection of soil conditions in the composition of the crop. A very consistent interrelation is found between potassium, calcium, and magnesium. Fertilization of certain soils with potassium may cause in the crop extreme alterations in the ratio obtained by dividing the equivalents of potassium by the sum of equivalents of calcium and magnesium. In this connection, magnesium may have a specially important rôle in certain soils. Further evidence has been obtained concerning the relation of replaceable potassium to the absorption of potassium by plants and to 'luxury' consumption of this element."

In a study of plant buffering systems, a deficiency in potassium or in phosphate was shown to increase the soluble nitrogen constituents of the sap and increase the buffer capacity against alkali.

A study by P. F. Nichols, C. D. Fisher, and W. J. Parks of the xylene distillation method of determining moisture in dried fruits indicated that from 6.5 to 10 minutes of distillation are sufficient, and that a corrective factor may be applied to the reading after 15 minutes of distillation, giving results usually correct within 1 per cent. A constant source of heat must be employed in the method.

E. M. Mrak and P. H. Richert found that there is apparently no direct relation between the electromotive force developed by tin and iron couples (the two metals found in tin plate) immersed in prune juice and corrosion of the electrodes. The iron became more noble than tin, and the tin, contrary to the usual condition, then dissolved more rapidly than the iron. Aluminum also reversed its potential in prune juice and became more noble than iron.

The tin dissolved by the juice was found mostly in the fruit rather than in the sirup, indicating either adsorption or precipitation. Nearly all of the oxygen disappeared from the head space in the tins during the first week of storage, nitrogen with a small proportion of carbon dioxide remaining. Hydrogen appeared later, but its quality was not correlated with that of the tin dissolved.

The corrosion rate of various alloys in vinegar was studied by Mrak and J. C. le Roux, the metals being exposed by simple immersion, by immersion with aeration, and by means of a fine spray, the last-named procedure producing the most rapid corrosion. "In a comparison of copper and copper alloys of known composition, an aluminum bronze was found to be the most resistant, and copper alloys containing lead least resistant. Tin bronze was fairly resistant. Various brasses corroded rapidly. Hard copper was more resistant than soft copper. Certain stainless steels (Allegheny metal in particular) were found very resistant to corrosion in vinegar. Agitation increased the rate of corrosion. Some metals tended to become passive by formation of a protective layer and the rate of corrosion decreased; others corroded at a uniform rate. Addition of 1,000 parts per million or less of cupric ions did not appreciably affect the rate of corrosion of copper. Addition of sodium chloride increased the rates of corrosion of aluminum and copper."

Ethyl formate was successfully used by G. L. Marsh in the fumigation of almonds. The undesirable "frosting" of the inner surface of glass containers of almonds which occurs rapidly in vacuum-packed almonds did not appear when the jars were vacuumized and then filled with nitrogen or carbon dioxide.

Richert found that an increase in concentration of neutral potassium tartrate (and in less degree of tartaric acid) greatly decreased the solubility and hence increased the separation of cream of tartar in grape juice and concentrate. In work by W. V. Cruess, Richert, M. A. Joslyn, and J. H. Irish, amino-acid and ammonia nitrogen markedly increased the rate of darkening of grape sirups and concentrates, as did also high sirup density and elevation of temperature. Darkening was less rapid in tin than in glass. P. J. Quin found the chlorine and hydrogen ions to be active inhibitors of oxidase activity in peaches and of value in checking darkening of fruits in canning, the best inhibitor being dilute hydrochloric acid.

It was found by Marsh that the drying of packaged fruit jelly candies could be greatly retarded by the use of a considerable proportion of invert sugar in the formula.

The oil content of olives was found by G. A. Pitman to be affected by the locality and the size of the fruit. No great differences were observed in the oil content of California Spanish-process green olives and imported green olives of the same varieties. Cruess found that the pH value of ripe olives at canning should lie between 7 and 8.3, and that spoilage of fresh olives in

storage brine could be prevented by adding a small amount of acetic acid. The splitting and "deep blistering" of Spanish-process green olives was found by Cruess and Pitman to be caused by the use of too strong a lye solution.

Equilibria between egg albumin and the salts of calcium and of potassium [trans. title], M. Guiffré (*Biochem. Ztschr., 229 (1930), No. 4–6, pp. 296–310, figs. 6*).—Egg albumin, freed from salts by electro-ultrafiltration, took up calcium salts (the chloride, the sulfate, and the thiocyanate) and potassium salts (as represented by the chloride) in increasing quantities from solutions of increasing concentration, up to a salt concentration of N/20, or 500 milliequivalents for each 100 gm. of the albumin, without indication of a saturation value, higher concentrations resulting in irregularities of unknown origin.

Two egg albumin preparations separately purified gave different absolute figures but the curves were of the same type. Albumin took up calcium from calcium chloride solutions of low and medium concentrations more strongly than it did potassium from corresponding solutions of potassium chloride.

The curves for calcium and potassium combination, nearly 100 per cent different at the lower salt concentrations, came almost together in the case of the more concentrated solutions. When both calcium chloride and potassium chloride were present at the same time, the two salts were found to be taken up additively. Calcium was taken up from the calcium salts about 10 per cent more from the sulfate than from the chloride, and about 25 per cent less from the thiocyanate than from the chloride, in accordance with the lyotropic series of the anions.

The effect of alcohols on the coagulation by heat of proteins in solutions buffered with acetates [trans. title], T. Teorell (*Biochem. Ztschr., 229 (1930), No. 1–3, pp. 1–15, figs. 7*).—Heat coagulation took place only between pH 4.7 and pH 6.2 under the conditions of the experiments described, either in the presence or the absence of ethyl alcohol. The presence of alcohols hindered heat coagulation in the order methyl alcohol$<$ethyl alcohol$<$propyl alcohol, the effect upon coagulation by chilling being an increase in the reverse order of effectiveness.

The reaction of interference with heat coagulation was associated with the presence of acetates and was the more marked in the solutions of the higher acetate concentrations. In the presence of less than from 15 to 20 per cent of the alcohol, the precipitate dissolved, entirely or in part, on heating, precipitating again on cooling. Pure serum albumin and native horse or human plasma behaved in alcohol-acetate media as above described, but such media were found to have scarcely any effect upon the coagulation of ovalbumin.

It is noted that the results here recorded indicate the possibility, in using alcohol in the test for the Bence-Jones protein, of confusing ordinary blood proteins with the protein for which the test is made.

On the condensation of pyridine- and quinoline-carboxylic acids with amino acids [trans. title], H. Meyer and R. Graf (*Biochem. Ztschr., 229 (1930), No. 1–3, pp. 154–163*).—The preparation, the identification, and certain of the properties of the following compounds are described: 2-pyridoyl-amino acetic ethyl ester and the corresponding free acid and its amide; 3-pyridoyl-amino acetic ethyl ester (ethyl nicotinurate), the methyl ester, and the free nicotinuric acid and its amide; the 3 corresponding 4-pyridoyl derivatives (isonicotinuric acid derivatives); the same set of 2-quinoloyl and 4-quinoloyl derivatives (quinaldinuric acid and cinchoninuric acid derivatives); 2-phenyl-4-quinoloyl amino acetic acid, its ethyl ester, and its amide; 3-pyridoyl-glycyl-glycine ethyl ester and the free amino acid; N-(3-pyridoyl)-anthranilic methyl ester and

the free acid; the corresponding 2-pyridoyl derivatives; and N-(3-pyridoyl)-anthranoyl-anthranilic methyl ester and the free acid.

On a convenient synthesis of phenylglyoxal [trans. title], C. Neuberg and E. Hofmann (*Biochem. Ztschr., 229 (1930), No, 4–6, pp. 443–445*).—Phenylglyoxal was found readily obtainable in yields of 40 per cent or more of the theoretical by treating isonitroso-acetophenone under suitable conditions with nitrosulfonic acid, an organic solvent being necessary because of the insolubility of the oxime in water. The following procedure is prescribed:

Dissolve 10 gm. of the oxime in 35 cc. of dioxane at room temperature, add 10 gm. of water to the solution, and cool to 0° C. Add, with shaking, and slowly enough so that the temperature does not rise above 5°, 8.5 gm. of nitrosulfonic acid (lead chamber crystals). Add a few of the pumice fragments used to prevent explosive boiling and warm to 40°. During the violent evolution of nitrous oxide which takes place at this point, control the reaction by dipping the flask in cold water, keeping the temperature below 60°. When the gas evolution ceases, wash the reaction mixture into a Claisen flask with 100 cc. of water and concentrate under diminished pressure to 70 cc. Extract the residue with three 50-cc. portions of ether and wash the ether extract two or three times with 10-cc. portions of water. Distill off the ether and extract the phenylglyoxal from the residual oil by boiling out with two 40-cc. portions of water, filter hot through a moistened filter, concentrate the filtrate under reduced pressure to about 30 cc., and cool in ice to bring about crystallization. Filter off the crystals by suction and boil out the residual oil again with this filtrate, from which now a small further portion of phenylglyoxal can be crystallized.

The formation and identification of the acids produced by various strains of propionic acid bacteria [trans. title], P. W. Wilson, E. B. Fred, and W. H. Peterson (*Biochem. Ztschr., 229 (1930), No. 4–6, pp. 271–280*).—The authors of this contribution from the Wisconsin Experiment Station report the investigation of 11 strains of propionic acid bacteria with respect to their capacity to ferment glucose, lactose, and maltose. Volatile acids were formed from these sugars in quantities varying with the strains. In pure culture the organisms studied used up only a part of the sugar, but in the presence of *Lactobacillus casei* practically all of the sugar was destroyed, from 25 to 75 per cent being recoverable in the form of volatile acids.

The more effective strains were tried also as fermentation agents for malted maize, for molasses, and for hydrolized starch. The two last-named materials were rapidly fermented, but with the flour made from malted maize the results were somewhat irregular. The strains showing the greater capacity for the fermentation of the pure sugars were the more effective also in their action upon the natural sources of carbohydrates. Yeast water and distillation residue from the acetone-butyl alcohol fermentation were shown to be suitable sources of nitrogen. Molasses was fermented without the addition of any source of nitrogen.

The acids produced were isolated and were identified as acetic and propionic acids, the last-named compound constituting from 65 to 70 per cent of the volatile acids.

On the splitting off of tyrosine and tryptophane from casein by papain activated with hydrocyanic acid [trans. title], T. Leipert and I. Häfner (*Biochem. Ztschr., 229 (1930), No. 4–6, pp. 427–432, figs. 2*).—In a 12 days' digestion of casein with papain-cyanohydrin it was found possible to obtain but 47 per cent of the total nitrogen in the form of amino nitrogen. In the course of this reaction the tyrosine was set free entirely, the tryptophane only partially, in parallel with the general rate of the splitting off of amino acids.

The combined action of papain-cyanohydrin and trypsin set free 71 per cent of the total nitrogen as amino nitrogen in a digestion of one week duration, but the additional enzyme did not affect the relative rate of production of tyrosine and tryptophane.

The effect of proteolytic enzymes on urease preparations [trans. title], J. Zakowski (*Biochem. Ztschr.*, *229* (*1930*), *No. 1–3*, *pp. 41–84*, *figs. 35*).—In extensive experiments, the rate of destruction by papain and by trypsin, acting at from 30 to 40° C. and at definite pH values, of the activity of preparations of jack bean urease reached from 70 to 80 per cent of the activity as measured by controls in the case of an experiment in which the ratio of papain preparation to urease preparation was 6 : 1, the time period 7 hours, and the temperature 40°. Even when the ratio was reduced to that of 1 : 6, the destruction of 52 per cent of the ureatic activity in 7 hours was found possible under certain conditions. The buffer solutions used (citrates, phosphates, ammonia, and pH 5, 7.4, and 8.9) were found to have practically no destructive action within the period of 7 hours and at temperatures ranging from 30 to 40°. Erepsin was without apparent effect upon the urease preparations used.

Studies on the enzymes of tobacco [trans. title], C. Neuberg and M. Kobel (*Biochem. Ztschr.*, *229* (*1930*), *No. 4–6*, *pp. 455–463*).—The presence in tobacco of amylase, invertase, phosphatase, pectase, glycolase, and ketoaldehydemutase was demonstrated. In each case it was found also that these enzymes did not lose their activity as a result of the rapid loss of water brought about by machine drying of the tobacco.

The enzymic clarification of grape juice, J. J. Willaman and Z. I. Kertesz (*New York State Sta. Tech. Bul. 178* (*1931*), *pp. 15*).—The authors find the turbidity of grape juice to consist largely of pectin in colloidal solution, so that ordinary filtration is without effect in clarifying the juice. It is shown, however, that "molds grown on appropriate media produce an enzyme which converts most of the pectin of grape juice into other soluble substances. A portion of the pectin comes down as a flocculent precipitate which occludes other suspended matter. By simple filtration this precipitate is removed, leaving a brilliantly clear juice."

The production of the enzyme from *Penicillium glaucum* and the practical use of the enzyme process are described in detail.

Factors influencing the pectin content of stored apple pomace, Z. I. Kertesz and E. L. Green (*New York State Sta. Tech. Bul. 179* (*1931*), *pp. 14*, *fig. 1*).—Dried and ground apple pomace, containing 7.5, 20, 33.3, 50, and 60 per cent of moisture, having been stored for five months and the amount of soluble pectin and acid hydrolizable pectin being determined, it was found that during storage changes which lowered the quantity and quality of the pectin extracted took place. These changes are attributed to the moisture content of the pomace rather than to enzymes. "No growth of mold could be observed on artificially infected apple pomace containing 20 per cent or less of moisture. In the pomace stored with 33 per cent moisture, the mold grew and the water-soluble pectin was decreased. In the sample containing 50 per cent of moisture, the soluble pectin and the pectin obtained by acid extractions have been found to be less than in the control sample without mold infection."

Edible canna, J. C. Ripperton, C. Richter, and E. V. Harrold (*Hawaii Sta. Rpt. 1930*, *pp. 13–15*, *fig. 1*).—The studies of the previous year (E. S. R., 63, p. 201) were completed.

It was found in the work here recorded that "plotting the composite curve of the concentration-swell product and viscosity on semilogarithmic paper on the logarithmic scale causes the graph to become a straight line. This relationship

makes it possible, by determining the swell at any given concentration, to find the viscosity in centipoises either by reference to a curve or by substitution in the equation of the curve. The swelling-power method, although not any more accurate than the viscosity determination, offers an advantage for factory control since it is rapid in operation and requires only simple apparatus."

Also, "in a continuation of the study of the relation of electrolytes to the properties of starches, depression in swelling power of the starches was found to coordinate closely with the valency of the cation, the numerical value of the depression being approximately 20 for monovalent, 30 for divalent, and 70 for trivalent cations. Treating raw starches with neutral salts of monovalent cations increased the swelling power and viscosity, whereas treating the swollen granules with the same kind of salts caused a depression."

With respect to the practical application of the canna product, it is noted that "results of a commercial trial of a 6-ton lot of edible canna starch were received by the station from a large starch distributor of the mainland. The distributor found the starch to be well adapted for use in making dextrin and for finishing textiles, two of the largest uses for the special starches. Canna starch could therefore be used as a substitute for cassava starch in dextrin and for potato starch in textile sizing."

Edible canna and potato starches showed marked similarity with respect to temperature, length of time of cooking, and effect of electrolytes on viscosity and swelling power. In both starches preliminary data indicated that the high-viscosity starches were less saturated with cations, as was indicated by pH and titration curves, than were those of low viscosity. They also contained smaller amounts of calcium removed by displacement with sodium chloride and by electrodialysis. Potato starches contained markedly greater quantities of cations and phosphoric acid than canna starches.

The illumination of the half-shadow polarimeter by means of the mercury vapor lamp [trans. title], H. N. Naumann (*Biochem. Ztschr., 229 (1930), No. 4-6, pp. 269, 270*).—With reference especially to the polarimetry of slightly rotating solutions, the author compares the arc light, with and without a 3-cm. filter of 3 per cent potassium dichromate, and the mercury vapor lamp, with and without a 3-cm. filter of 5 per cent nickel sulfate, with the sodium light.

The mercury vapor lamp with the nickel sulfate solution light filter was found to be from two to three times as accurate in the readings permitted as was the arc light, and is considered to be applicable in most cases. The percentages of error found, sodium light readings taken as the standard, were for the arc light without filter, 2; for the arc light with the dichromate solution filter above noted, 0.3; for the mercury vapor lamp without filter, 0.7; and for the mercury vapor lamp with the nickel sulfate filter above specified, 0.3. The critical angle, percentage error, the observed $[\alpha]^{*}$, and other data are given for each light source.

METEOROLOGY

Physics of the earth.—III, Meteorology, H. H. Kimball et al. (*Bul. Natl. Research Council, No. 79 (1931), pp. XI+289, figs. 101*).—This is one of a series of bulletins on physics of the earth designed "to give to the reader, presumably a scientist but not a specialist in the subject, an idea of its present status together with a forward-looking summary of its outstanding problems." It contains an introduction, by H. H. Kimball, briefly reviewing Development of the Science of Meteorology, and chapters on The Atmosphere: Origin and Composition, by W. J. Humphreys (pp. 1-14); Meteorological Data and Meteorological Changes, by A. J. Henry (pp. 15-34); Solar Radiation and Its Rôle, by H. H.

Kimball (pp. 35–66); The Meteorology of the Free Atmosphere, by W. R. Gregg, L. T. Samuels, and W. R. Stevens (pp. 67–132); Dynamic Meteorology, by H. C. Willett (pp. 133–233); and Physical Basis of Weather Forecasting, by R. H. Weightman (pp. 234–279). Each of the chapters includes a bibliography.

Correlation of atmospheric pressure and precipitation with sun spots [trans. title], A. JATHO (*An. Soc. Cient. Argentina, 111 (1931), No. 4, pp. 209–233, figs. 7; Fr. abs. pp. 209, 210; 5, pp. 295–304*).—From a somewhat detailed study of the subject, the author concludes that in certain cases variations in atmospheric pressure, and especially in precipitation, coincide with the number of sun spots. The solar barometric correlation is large in regions and periods of barometric calm, especially in the barometric calms of the equatorial zone (Colombo, Batavia, and Manila) and in winter in the zones of high atmospheric pressure (seacoast of Argentina, Madagascar, and the interior of Siberia). The solar rainfall correlation is large in regions and periods of well-defined winds which bring rain (Argentina in summer, Madagascar and New Zealand in winter). There is also a high solar rainfall correlation for regions of rainfall due to ascending air currents resulting from solar radiation, as for example, in Mendoza in the equatorial region.

The original is in Spanish.

Meteorological records: A forty-year summary, 1889–1928, C. I. GUNNESS (*Massachusetts Sta. Bul. 270 (1930), pp. 207–226*).—Tables are given which show mean, maximum, minimum, and range of pressure and temperature, mean relative humidity, mean percentage of cloudiness and hours of bright sunshine, precipitation, and movement and velocity of wind for each month and year of the period 1889–1928, as observed at Amherst, Mass., as well as dates of last and first killing frosts and data regarding number of days of precipitation and of clear, fair, and cloudy days.

The highest temperature observed during the period was 104° F. July 4, 1911; the lowest −26° January 5, 1904. The highest annual precipitation was 57.05 in. in 1897; the lowest, 30.68 in 1908. The mean annual precipitation for the period was 43.44 in. The greatest annual snowfall was 78 in. in 1920; the least, 24.5 in. in 1919. The mean cloudiness for the period was 50.8 per cent.

Meteorological observations, A. BISSERUP (*Virgin Islands Sta. Rpt. 1930, pp. 18, 19*).—Observations on temperature, rainfall, evaporation, and wind at the experiment station on St. Croix are summarized for each month of the year ended June 30, 1930. The summer temperatures were about normal. The maximum temperature was 90° F. October 26, 1929, the minimum temperature 58° March 22, 1930. The rainfall for the year, 37.77 in., was below normal, although unusually high in January. Evaporation amounted to 65.7 in.

SOILS—FERTILIZERS

A handbook of soil science, II, edited by E. BLANCK (*Handbuch der Bodenlehre. Berlin: Julius Springer, 1929, vol. 2, pp. VI+314, figs. 50*).—Volume 1 of this handbook has already been noted (E. S. R., 61, p. 503). Of the present volume, the first section (the second like division of the work as a whole) takes up, under the general title scientific fundamentals for the consideration of the soil-forming process, various climatic and other factors in soil formation. The second part of the present volume, under the general head of the effect of physical, chemical, geological, biological, and special factors on the original material, discusses weathering in general, physical weathering, chemical weathering, decomposition of organic matter, and biological weathering due to living organisms. Various authors have contributed certain of the smaller subdivisions.

Soils of Hill County, L. F. GIESEKER (*Montana Sta. Bul. 246 (1931), pp. 46, pls. 4, fig. 1*).—Hill County is described in the reconnaissance survey here reported as covering an area of 2,892 square miles, in north-central Montana.

Soils mapped and described in this report consist of Scobey loam, which occupies 40.6 per cent of the total area, Phillips loam, amounting to 22.1 per cent, and other soils making a total of 18 types of 12 series. Small unclassified land areas are occupied by bad lands, lakes, and mountains.

[Soil Survey Reports, 1926 Series] (*U. S. Dept. Agr., Bur. Chem. and Soils [Soil Survey Rpts.], Ser. 1926, Nos. 35, pp. 31, fig. 1, maps 2; 36, pp. 54, fig. 1, maps 2*).—The reports here noted were prepared with the cooperation of the University of Nebraska State Soil Survey.

No. 35. *Soil survey of Lincoln County, Nebraska,* A. W. Goke et al.—Lincoln County, Nebr., occupies an area of 1,623,040 acres in the southwestern part of the State, forming physiographically a part of an extensive plain modified in various degrees by wind and stream erosion. The North Platte, South Platte, and Platte Rivers provide drainage.

The soils of the county consist mainly of 40.8 per cent of dune sand, 14 per cent of Colby very fine sandy loam, and 33 other classified types of 14 series.

No. 36. *Soil survey of Custer County, Nebraska,* F. A. Hayes et al.—Custer County, central Nebraska, has an area of 1,656,320 acres, possesses the general physiography "of an upland plain ranging from almost level to steeply rolling or hilly," and is drained, for the most part thoroughly, by the three Loup Rivers and their tributaries.

The principal soils of this area are here listed as Colby silt loam, amounting to 31.3 per cent, Holdrege silt loam 11.2 per cent, dune sand 10.6 per cent, and 30 other types, with a total of 14 series.

A comparison of methods for determining the volume-weight of soils, A. S. CURRY (*Jour. Agr. Research [U. S.], 42 (1931), No. 11, pp. 765–772, figs. 2*).—This paper reports a comparative study made at the New Mexico Experiment Station of five different methods of determining soil-volume weights. These tests were made on Gila clay adobe to a depth of 5 ft., and the conclusions are based on the study of only this particular soil. Ten determinations were made with the cylinder method, 20 with the viscous-fluid method, 20 with the rubber-tube method, 40 with the improved soil-tube method, and 80 with the sand method. In all 170 determinations were made in an area about 20 by 2.5 ft.

"The cylinder method gave reliable and satisfactory results. The viscous-fluid method gave such variable results that it can not be recommended for such conditions as prevailed in these experiments. The sand, rubber-tube, and improved soil-tube methods rank about the same so far as the variability of the results is concerned. To secure accurate results with these methods, a correction factor should be used."

Physical properties of Hawaii soils, with special reference to the colloidal fraction, C. RICHTER (*Hawaii Sta. Bul. 62 (1931), pp. 45, figs. 12*).—It is noted that the Hawaiian soils, having been formed under tropical conditions and almost exclusively from basaltic lava or volcanic ash, are of wide variety, "and are quite unlike those . . . of the mainland of the United States." Of these soils, 21 were investigated with respect to variations in real and apparent specific gravity, hygroscopic and capillary moisture, moisture-holding capacity, and moisture equivalent, and the correlations of the moisture figures with texture and organic matter content.

"A considerable portion of the organic material is often in the noncolloidal fraction. With soils the organic content of which is small, the textural conditions and the chemical composition are the determining factors. Sometimes large differences exist in the silica sesquioxide ratio of the different fractions in any one soil. . . .

"For mechanical study the electrical stirrer was found to be far superior to either of the methods of shaking or rubbing. For chemical treatment prior to dispersion it was found that in most cases cold N/20 hydrochloric acid is satisfactory for the removal of calcium, that the destruction of organic matter with hydrogen peroxide is not necessary, and that sodium carbonate is the best agent to aid deflocculation.

"The percentage of colloids was determined by the water-vapor adsorption method. The figures obtained were too high, sometimes being abnormally in excess of the figures indicated by the pipette or the hydrometer method. This was chiefly due to the amount and distribution of the organic material and also to disparity in the chemical composition of the inorganic phase.

"The pipette and hydrometer methods of mechanical analysis are compared. The detailed hydrometer method, which takes into account the specific gravity and temperature, gives a good agreement with the pipette method. The rapid hydrometer method, while showing greater disagreement with the pipette method than does the detailed hydrometer method, is sufficiently useful for the routine classification of soils."

Capillary phenomena in colloidal soils, H. A. Wadsworth (*Hawaii Sta. Rpt. 1930, pp. 37, 38*).—A study was made of the factors affecting the rate and height of capillary rise of water through colloidal soils supported over a free water table and of the rates of rise of liquids through minute glass tubes. The mathematical theory of the last-named case is discussed briefly, the equation being considered to be: $R=K\ (l-e^{-cT})$, where K and c are constants, R=rise in cubic millimeters after T seconds, and e=base of natural logarithms. Applying the same principle to soils, it was found, however, that "the action is much more complex when carefully screened soils are used. The initial phase of the rise is similar to the form indicated above, but no asymptotic value is reached, the rise continuing long after the term e^{-cT} becomes zero. Consequently, another factor must be taken into account when clean inert sands are used. One hundred and twenty observations were made with five carefully graded sand sizes and a form of expression developed which fits the observed points with surprising precision. The formula may be expressed thus: $R=K\ (l-e^{-cT})T^n$. This formula may be used when the notation is as in the first formula given above, and n equals the natural tangent of the slope caused by plotting logarithmic rise against logarithmic time for values of T larger than that for which e^{-cT} equals zero." The physical significance of the data is further discussed.

Dispersion of soils by a supersonic method, L. B. Olmstead (*Jour. Agr. Research* [*U. S.*], *42* (*1931*), *No. 12, pp. 841–852, figs. 3*).—Samples of from 10 to 30 gm. of air-dry soil that had been passed through a 2-mm. colander plate were wetted with from 50 to 125 cc. of water in a specially made Erlenmeyer flask, of which the bottom was only about 0.7 mm. in thickness. The flask was then set into an oil bath about 1 to 2 cm. above a large piezoeletric quartz crystal actuated by a 1.5 kw. vacuum-tube oscillator, adjustments being such as to communicate as vigorous a supersonic vibration as possible to the contents of the flask. Each treatment was continued for about 2 minutes, during which process the soil suspension was so strongly agitated as to appear to boil violently, and the actual temperature was in some cases raised to the boiling point.

Of the effectiveness of this procedure as a dispersion method, it is stated that "the percentage of colloidal material extracted from soils by the new method is about the same as is secured by a rubbing method and is slightly greater than the percentage obtained from analyses by the pipette method. In neither the supersonic nor the rubbing method of dispersion was the extraction complete. A small and decreasing yield of material of colloidal size was obtained as long as the extraction processes were continued. The results, however, are much more quickly and easily obtained by the supersonic method.

"Determinations of the water vapor absorbed over 3.3 per cent sulfuric acid by the silt and colloid fractions showed no differences between the material extracted by the two methods. The water vapor absorbed per gram by the silt fraction ranged from 5 to 15 per cent of the absorption of the corresponding colloid."

Physico-chemical aspects of soil acidity (*Michigan Sta. Bien. Rpt. 1929–30, p. 19*).—This work on adsorption of invertase has been previously noted (E. S. R., 65, p. 413).

Effects of clover and alfalfa in rotation, II–IV, W. P. Headden (*Colorado Sta. Buls. 362 (1930), pp. 131, figs. 3; 363 (1930), pp. 39, figs. 12; 364 (1930), pp. 77, figs. 3*).—These parts complete the work previously noted (E. S. R., 57, p. 113).

Part 2 deals mainly with the effect of the rotation grown upon the soil nitrogen and potassium.

"Our preliminary results justified us in assuming the presence of large quantities of carbon dioxide under the crops. We assumed that the water-soluble potash or, better, potassium would bear a relation to the carbon dioxide in the soil atmosphere. In the fallow there was a moderate supply, under the wheat a big supply for a little while, but under the clover and alfalfa a great deal all the while, even in the winter season. . . . The wheat seems to have used more than the carbon dioxide set free. The clover and alfalfa used a great deal for the crop was good, but there was an excess. The gain was 800 lbs. of potash in the top 2 ft. of soil in two years. This is equal to 1,600 lbs. of potassic sulfate.

"The effects of plowing under the crops were surprising in two respects; both the carbon dioxide and the soluble potassium fell. The change in the amount of the carbon dioxide or carbonic acid in the soil may have affected the solubility of the potassium. . . . When carbonated water was used the potassium was quite readily soluble, which suggested the statement just made that the falling off in the amount of soluble potassium may have been due to the falling off in the carbon dioxide. Carbonated water dissolved more than twice as much as carbonic-acid-free distilled water. . . .

"The effects of clover and alfalfa in a rotation are not to increase the nitrogen supply but to add to the supply of the water-soluble potassium and to improve the mechanical and sanitary conditions of the soil. They effect the former by maintaining an abundant supply of carbon dioxide in the soil air throughout their occupancy of it.

"Cultivating fallow is more effective in increasing the nitric nitrogen in the soil than either clover or alfalfa. It maintains a moderate but, within certain limits, a constant supply of carbon dioxide in the soil air which brings potassium into solution. But a very much smaller amount of carbon dioxide is maintained in fallow than in clover or alfalfa land. The carbon dioxide is the effective agent in bringing the potassium into a soluble form."

Part 3 deals especially with the effects of legumes as compared with those of fallow. Among numerous and detailed conclusions is the statement that "there is something in the land after two years in clover or alfalfa, besides any modification in the amount of plant foods, that is favorable to the vegetative functions of the plant; in this case we have this effect contrasted with that of the corn which is not favorable to the vegetative functions of the wheat plant; *it is toxic. This toxic property is absent from the fallow* land and the favorable effect of alfalfa or clover is, in a large measure, wanting. We have indicated this as a sanitary condition of the soil which does not adequately indicate the condition. The corn land influenced the development of the wheat plants unfavorably; it was toxic. In this case we believe that there is something present whose nature is not more nearly known, but we speak of it as a toxin. In the case of clover and alfalfa there is something that favors growth. We might call it favorin."

Part 4 adds the data of another year of the rotation, the results being largely confirmatory of observations and conclusions already indicated.

"In regard to the nitric nitrogen we found it always low in the alfalfa and clover ground compared with fallow ground. Ten parts per million in the very uppermost portion of the soil were about the maximum; from 1 to 3 parts were common. The only two really high results obtained in a whole season's sampling were 33 and 37 parts per million for samples scraped off the surface under the alfalfa plants, and these were mixed with still undecomposed plant débris. *Whether the small amount of nitric nitrogen found* associated with alfalfa plants is due to the prohibition of its formation or to its exhaustion by the plant may be a question, but there is no question about the fact that it is low from the surface to a depth of 11 ft. Whatever the facts may be regarding the exhaustion, we believe that the growing plant exerts a prohibitive influence upon the process of nitrification."

[Soil technological investigations of the California Station] (*California Sta. Rpt. 1930, pp. 91–95*).—A study of single-value soil properties, erosion and run-off observations, fertility trials, peat studies, soil temperature investigations, and other soil studies are very briefly noted, advancing for the most part experiments noted from previous reports (E. S. R., 62, p. 717).

Soil fertility investigations, sugar cane district of Louisiana, A. M. O'Neal and S. J. Breaux, jr. (*Louisiana Stas. [Bul. 222], [1931], pp. 45, figs. 27*).—The U. S. D. A. Bureau of Chemistry and Soils, with the cooperation of the State experiment station, has made a reconnaissance survey of the sugarcane soils, and reports also one year's fertilizer tests on seven fields. In addition to specific local results from each field, rate and source of nitrogen application, correlation of soil type, pH value, tonnage, and sugar content, and the carry-over effect of fertilizers from row to row are discussed, and in a brief *appendix the calculation of the percentage figures of the triangle experiments* to pounds to the acre is shown.

[Soil and fertilizer work of the Michigan Station] (*Michigan Sta. Bien. Rpt. 1929–30, pp. 47–52*).—The following investigations are noted:

Duration of lime in soils.—The experiments here briefly discussed "demonstrate the necessity of frequent tests to determine the lime needs of soil which is to be seeded to legumes, since a moderate application of limestone may suffice for many years on one soil type while frequent repetitions of the treatment may be necessary on another soil showing no greater original acidity."

Pasture fertilization.—"The data at present indicate that, for immediate results, nitrogen is especially valuable as a top-dressing for pastures on all soils investigated. In many cases, phosphoric acid and potash also are very

beneficial. The best results during the past three years have been produced on the plats which were fertilized with a complete fertilizer containing a fairly high percentage each of nitrogen, phosphoric acid, and potash."

Fertilization of canning tomatoes.—The experiments noted indicated that "a mixture containing 16 per cent phosphoric acid and 16 per cent potash with no nitrogen gave the most economical returns. Five hundred lbs. per acre was a a more profitable rate of application than 250 lbs., while increases in yield from heavier applications were not sufficient to warrant the additional expense. Most of the fertilizer treatments hastened maturity of the crop, thus increasing the amount of fruit picked before frost."

Fertility experiments on the Ontonagon soil type in Chippewa County.—"Several fertilizer mixtures have been tried on this soil with varying results. There has been little or no measurable response to fertilizer treatments so far by flax, sunflowers, or peas. Rutabagas have responded favorably to nearly all fertilizer treatments, the largest yield being 22.5 tons per acre coming from a plat treated with 300 lbs. of 6–16–4, adjacent to a check plat which yielded a little over 11 tons. Oats and barley have also responded favorably to fertilizer treatments. The results in case of both crops have been in favor of a complete fertilizer carrying a high percentage of nitrogen. This kind of fertilizer not only produces a higher yield but also matures the crops more than a week earlier than no fertilizer or superphosphate alone. This effect seems to be due to the readily available nitrogen which gives the plants a rapid start in the spring."

Fertilization of late potatoes.—With the use of a 4–16–8 fertilizer, "profitable increases in yield with increased rates of application were obtained up to 750 lbs. per acre, but with heavier rates of fertilization no appreciable increases in yield were obtained."

Fertilization of old stands of alfalfa.—Trials of various formulas indicated that "on the Wisner soil a fertilizer containing a liberal quantity of phosphoric acid, somewhat less potash, and no nitrogen, such as a 0–14–6, at the rate of 500 lbs. per acre gave the best results on land which had not been manured for three years. On a field which had received manure the previous year, superphosphate alone at the rate of 500 lbs. to the acre proved the most satisfactory treatment. The Brookston soil showed less need for potash and a reduced requirement for phosphoric acid. On recently manured land, 200 to 300 lbs. of superphosphate proved sufficient. When no manure had been used recently, the 0–14–6 mixture proved advisable, but a lighter application, running from 200 to 300 lbs. to the acre was adequate."

Muck soil investigations.—The muck soils of the State are here classified into the three groups (1) low lime mucks, highly acid, and the least productive of the three, (2) high lime mucks, neutral to acid in reaction, inclusive of "a large majority" of the muck soils of the State, and of which it is stated that "when properly fertilized and drained, they are very productive," and (3) muck soils containing an excess of lime, alkaline in reaction and response (in some cases to the extent of nearly 400 per cent crop increases) to treatment with sulfur. The work noted has further shown that "the great majority of Michigan mucks are in need of both a phosphate and a potash fertilizer within a relatively few years after they are reclaimed. . . . In general, the very acid types of muck show a greater need for nitrogen than do the high lime muck soils. Mucks which have been cropped for a long period of years are likewise more responsive to nitrogen than are those which have not been long under cultivation. Mucks which have a high water level usually show more response to nitrogen than do those which are better drained."

[Soil and fertilizer investigations], G. HARDMAN, F. L. BIXBY, R. STEWART, and V. E. SPENCER (*Nevada Sta. Rpt. 1930, pp. 19, 20, 23*).—The following items of this report fall under the above heading:

Cooperative fertilizer trails.—In advance of the completion of chemical and physical studies of the soils of the Las Vegas region, an attempt has been begun to secure improvement in their productive capacity by the use of manures and commercial fertilizers. The quantity and quality of orchard fruits was improved by potassic and phosphatic fertilizers. Asparagus and cantaloupes did not respond to commercial fertilizers, whereas carrots and onions "gave marked increases following applications of potassium sulfate, although the soils in which they were grown appeared to be well supplied with potash. This raised a question whether previous increases in yields on vegetable plats treated with complete fertilizer might not have been due to the potash instead of to the nitrogen or the phosphorus of the fertilizer. In the present year's tests neither nitrogen nor phosphorus gave any increases in yield.

"Very marked increases in hay tonnage were obtained by treating alfalfa fields with superphosphate. Analyses of hay not treated showed a marked deficiency of phosphorus in comparison with normal standards. Treatment with phosphate fertilizers raised the phosphorus content of hay grown on the treated fields almost to the normal standard."

Land reclamation.—In a study of "raw desert lands," it was found that "treatment with barnyard manure was the only means of increasing fertility that gave consistently high returns on all the plats. Treatment with ammonium sulfate appeared to be of questionable value, slight increases in yields were obtained by the use of potash and phosphorus fertilizers, but barnyard manure gave decided increases in yield and put the soil into much better physical condition for subsequent cropping. Lettuce and beets on test plats with barnyard manure gave marked increases, they showed less benefit from potash and phosphorus, and gave poor yields on the check plats and those treated with ammonium sulfate."

An attempt to determine the value of nitrogen in the unhumified soil organic matter of gypsum and allied desert soils of the Las Vegas Valley of southern Nevada.—"The most difficult problem in such soils is their lack of humus. Studies of the humus content of these soils brought out the fact that accepted methods of studying humus need revision, and that methods better adapted to the soils in question are greatly needed. In 1929–30 several new methods of separating the humus from the remainder of the soil were devised. These methods promise to make further progress possible and ultimately to throw light on the whole humus problem."

A study of the chemical and physical phenomena of the so-called "slick spots," impermeable areas in the gypsum soils and allied soils of the Moapa and Las Vegas Valleys of southern Nevada.—"These studies have led to the conclusion that the observed condition of plant growth on the slick spots and the lack of improvement after treatment with commercial fertilizers may be due less to poisoning than to starvation caused by the fixation of plant food in an unavailable form by basic materials common to these soils."

Ammonification of nitrogenous substances by pure cultures of microorganisms, H. C. PULLEY (*Jour. Agr. Research [U. S.], 42 (1931), No. 11, pp. 791–800, figs. 2*).—Asparagine, peptone, gluten, urea, casein, gelatin, dried blood, uric acid, egg albumin, hippuric acid, and acetanilide were added to soil, and the sterilized mixtures were inoculated separately with 19 cultures of soil microorganisms inclusive of four molds in the experiments here reported from the Utah Experiment Station and were tested for accumulated ammonia after four days. The order of availability of the compounds to the ammonifying

organisms was that in which they are listed above, save that sterile soil alone yielded more ammonia than did the acetanilide cultures, while calcium cyanamide, caffeine, and diphenylamine, also tested for availability to ammonifiers, yielded no determinable ammonia. "Urea and uric acid owe their relatively high position to the activity of culture 10-B and would otherwise succeed egg albumin. Calcium cyanamide does not decompose with the formation of urea in the soil here used. The most active urea organisms and even the unsterile soil did not ammonify the cyanamide.

"The ammonifying power of soil microorganisms is quite general on amino nitrogen. The nitrogen groups of the purine bases are resistant to the organisms here studied. There are no known criteria by which the ammonifying property of bacteria can be predicted. Culture 10-B is an outstanding ammonifier of urea and uric acid. This is quite independent of its relatively low ability to ammonify other combinations of nitrogen. Ammonification in liquid media is lower than in soil, but there is no definite correlation between the two. Some nitrogenous substances which are themselves not measurably ammonified retard or prevent the accumulation of ammonia from other sources."

The rate of absorption of potassium by plants and its possible effect upon the amount of potassium remaining in soils from applications of potassium fertilizers, R. P. Bartholomew and G. Janssen (*Arkansas Sta. Bul. 265 (1931), pp. 70, figs. 20*).—Culture solution, soil culture, and field experiments on the uptake of potassium by plants are reported with cowpeas, corn, Sudan grass, and soybeans. The following are included among a large number of recorded observations:

"Plants take up large amounts of potassium very rapidly when conditions for good growth are favorable. The nature of the culture media, whether water solutions or soil cultures, did not affect the general rate of absorption. Potassium was taken up by plants during the night just about as readily as during the day. Plants take up potassium rapidly at all stages of development if a good supply of available potassium is maintained in the feeding area of the roots. Rapid reduction of the concentration of potassium in solution did not interfere with absorption of potassium. The plants rapidly readjusted themselves to the new conditions, and fed upon the potassium in the small concentrations.

Fixation of potassium into a nonreplaceable form was a relatively slow process when no plants were growing, whereas in soils seeded to crops the fixation seemed to take place rapidly. . . . Potassium reverted from a replaceable to a nonreplaceable form may change back to the replaceable state rather rapidly. The results suggest that the reversion takes place in several stages, producing compounds of different degrees of solubility. The amount of potassium in the soil solutions appears to be a specific function of the amount of replaceable potassium in the soil.

"The results indicate that plants have a maximum capacity for absorption of potassium. Absorption at this rate will be maintained throughout the life of the plants, if sufficient available potassium is maintained in the feeding area of the roots.

"Due to the tremendous absorbing power of plants growing under favorable conditions there is not likely to be any residual effect from additions of potassium fertilizers, if crops are removed from the soil. . . . Crops grown removed in the tops more potassium than was added in the fertilizer." It further appeared that "rapid absorption of potassium by plants during the early stages of growth so depletes the supply of available potassium in the soil that plants have to translocate and reutilize the potassium previously taken up in order to maintain good growth during the latter stages of development." This ap-

peared to represent the usual case, "whereas continued absorption in large amounts throughout the life of the plant would be considered the normal method of feeding for potassium."

AGRICULTURAL BOTANY

[Plant physiology studies at the California Station] (*California Sta. Rpt. 1930, pp. 46, 47*).—Studies of citrus cuttings showed that during the rooting process changes occur in the percentage of calcium and potassium in the water-soluble ash. In stem cuttings the greatest reduction in soluble calcium occurred in the stem and of potassium in the leaves. Rooted leaf cuttings in culture solutions of different concentrations of calcium increased abnormally in potassium, but the calcium content was nearly constant. Magnesium solubility was not affected during rooting.

Boron in minute quantity is conceded essential to healthy growth of citrus, apparently being concerned with cell division in the meristematic tissue, particularly the cambium. An abnormal accumulation of carbohydrates in the leaves followed boron deficiency. Concentrations of 0.2 part per million of boron in the culture solution were adequate to prevent or remedy boron deficiency.

With the aid of oxidation reduction indicators it was possible to distinguish injuries to walnuts which had been overheated in the dehydration process.

A comparison of healthy Deglet Noor date palms with those suffering from decline showed less nitrogen, potassium, and phosphorus, and more calcium in the affected trees. Copper sulfate added to the soil gave promise as a remedy.

Studies in citrus transpiration indicated that approximately 6 to 12 times as much water vapor is transpired through the ventral side of the leaf (with stomata) as through the dorsal side (with no stomata). Most, if not all, the stomata on the mature leaf apparently function normally.

[Plant physiology studies at the Michigan Station] (*Michigan Sta. Bien. Rpt. 1929–30, pp. 16–18*).—Soybeans and tomatoes exposed in the greenhouse to ultra-violet light were injured in every case by wave lengths less than 300 mm. when the plants were exposed 4 minutes daily at a distance of 1 meter from the source of light and during a period of from 6 to 12 weeks. It was possible to filter out these rays or to lessen their injury by increasing the distance from the light. Time of day was a factor in irradiation, as shown in the fact that a daily treatment of 1 minute at 9 a. m. increased the dry weight 10 per cent, whereas a similar treatment at 3 p. m. resulted in a 7 per cent decrease. Irradiation for 2 minutes per day at 1 meter decreased dry weight because of lethal effects. Losses of 33 per cent were recorded, while the same treatment for 0.5 minute caused a 17 per cent increase. The nitrate protein ratio was apparently increased with increased irradiation. Changes were observed in the lipoidal content. When irradiation was too strong, blossoming and ripening were delayed, but with briefer exposures they were accelerated, depending upon the time irradiated.

Modifications in the calcium and potassium nutrition of garden peas grown under three different lengths of days produced different effects on the transformation and utilization of carbohydrates and proteins. Total sugars in the tops reached the maximum in high light intensity only when calcium was proportionately increased. Total hemicellulose, starch, and dextrin decreased with an increase of light, indicating a utilization of reserves in the presence of increased calcium and light. Potassium deficiency did not appreciably reduce carbohydrate synthesis but did interfere with translocation, apparently by reducing the activity of the diastase enzyme. The rate of absorption of calcium and potas-

sium, both essential to protein synthesis, is deemed dependent on light duration. Total nitrogen accumulates in short light but is proportional to the amount of calcium. In long light and regular daylight the utilization of total nitrogen is proportional to the amount of calcium present. Nitrate nitrogen accumulates in short daylight, utilization increasing with longer daylight, dependent on the amount of calcium present. Longer daylight exposure apparently favored an increase of total nitrogen in the roots. Potassium had the same effect but to a lesser degree.

In the presence of inadequate calcium, the tendrils dried up and the leaves curled and gradually lost their chlorophyll, with the margins last to lose color. The terminal buds were either killed or checked and axillary buds developed at the base of the stem. The roots were soft and jellylike, with constrictions often formed near the tips.

The physiology of growth and of stimulational movement in roots [trans. title], E. BÜNNING (*Ztschr. Wiss. Biol., Abt. E, Planta Arch. Wiss. Bot., 5 (1928), No. 4, pp. 635–659, figs. 5*).—Carrying forward the general purpose of his study, previously noted (E. S. R., 59, p. 517), the author in the present work sought to ascertain how woundings and other stimuli influence growth.

Wound changes in stimulants affect plasma adversely, the injury conditioning growth check and dwarfing of cells. The injuries to plasma and their consequences decrease with distance from the point of trauma. Traumatropisms are explainable as results of the changes indicated.

GENETICS

[Plant breeding and genetics at the California Station] (*California Sta. Rpt. 1930, pp. 37–39, 72–75*).—Dwarf varieties and dwarf strains of tomatoes of hybrid origin resistant to curly top under natural infection showed moderate resistance when artificially inoculated in 1928 and 1930, but displayed no resistance in 1927 and 1929. Resistance to curly top is believed to lie in a tendency to escape infection rather than an ability to resist the virus after the infection occurs. The probability of infection increased with the number of leafhoppers used in inoculation. The efficacy of shading tomatoes for the control of curly top was more apparent than actual, since shading merely inhibited the symptoms of the disease.

Delayed foliation of peaches in southern California followed the mild winter of 1929–30. Peento and the most resistant hybrids flowered earlier than usual in years of delayed foliation, and may therefore serve as forecasters of the trouble in susceptible varieties. Most of the seedlings derived from crosses between resistant hybrids and commercial varieties were quite resistant to delayed foliation.

In crosses with pure single races of Matthiola the F_2 ratios for doubleness from F_1 plants of the primary trisomic crenate strain corresponded well with the normal trisomic expectation derived from the Haldane-Waddington two-lethal hypothesis, a situation also true with respect to the very different ratios given by the fragment secondary slender strain when the constitution and behavior of the extra chromosome are considered. Seed of several flower colors from F_2 hybrid slenders were secured. Several new cases of bud variation, explainable by the loss of an extra chromosome, were noted. The presence of an exceptional abundance of mutants in F_2 cultures from one cross suggested a sectional interchange between chromosome pairs in the ancestry of one parental race.

In citrus breeding evidence was secured that the trunk of a thorny seedling or a tree budded from a thorny seedling and the proximal portion of its main branches retain probably indefinitely the ability to produce thorny

shoots, which, if used as source of buds, produce thorny trees. Shoots far from the trunk showed a tendency to progressive reduction in thorniness. Trees budded from young seedlings of apogamic origin did not blossom as young as trees budded directly from the orchard. As seedling thorniness declined in successive propagations by budding, the trees tended to bloom earlier. The average development of the navel structure was less in apogamic progeny than in fruits of the same variety from orchard trees.

Taxonomic, cytological, and genetic research was continued with species of the genus Crepis (E. S. R., 62, p. 723). Comparison of somatic chromosomes in about one-third of the known species, together with evidence from external morphology and genetics, furnished some indication of the internal processes which have operated or are operating to bring about the origin and differentiation of species. These processes fall into the general categories, genic mutation, chromosomal variation, and interspecific hybridization. Brief reports of studies by L. Hollingshead, M. Navashin, C. F. Poole, and others are cited to indicate the trend of the investigations.

The genetics of cotton,—Part IV, The inheritance of corolla colour and petal size in Asiatic cottons, J. B. HUTCHINSON (*Jour. Genetics, 24 (1931), No. 3, pp. 325–353, pl. 1*).—The present paper of this series (E. S. R., 65, p. 121) is concerned with the Asiatic Gossypiums, among which corolla color ranges from deep yellow to ivory white, forming a color series very similar to that described by Harland for the New World Gossypiums.

Correlated inheritance in a cross (Sevier×Dicklow)×Dicklow wheats, G. STEWART and R. K. BISCHOFF (*Jour. Agr. Research [U. S.], 42 (1931), No. 11, pp. 775–790, figs. 3*).—The inheritance of culm length, stature, number of culms, awn classes, spike density, and glume color were studied into F_4 at the Utah Experiment Station in a cross between F22 (Sevier × Dicklow), fully awned with bright bronze glumes, and Dicklow with short awns and white glumes. Mean values in the parent rows were for F22 and Dicklow, respectively, length of longest culm to base of spike 108.4 and 103.8 cm., spike density (length of 10 rachis internodes) 25.6 and 50, and number of culms per plant 11.6 and 9.4 cm.

The parental range for culm length was recovered in the progeny, and no segregating groups besides dwarfs were revealed. One dominant dwarf factor and an inhibitor factor evidently were operating in the inheritance of stature in this cross. The parents were essentially alike in number of culms per plant, and segregation was not observed in the progenies. A single factor difference was noted in awn class inheritance, the awn types of both parents being recovered and also a segregating awn class. One major factor difference was found operating in spike density inheritance. A major and one or more minor differences probably operated to bring about the recovery of the F22 parent spike and the greater laxity of the true-breeding lax progenies as compared with the Dicklow spike.

The correlation between awn length and spike density in the fully awned progenies was $r = +0.406 \pm 0.094$, and that comparing spike density in the F_3 progenies and in the F_4, $+0.378 \pm 0.038$, was indicative of stability of behavior for the character. Other correlations indicated that soil heterogeneity was measurably noticeable in the field, and that considerable competition existed between the contiguous rows.

Heredity, A. F. SHULL (*New York and London: McGraw-Hill Book Co., 1931, 2 ed., pp. XV+345 pl. 1, figs. 143*).—This is a revised and enlarged edition of the work previously noted (E. S. R., 55, p. 522).

On chromosome balance as a factor in duration of life, J. W. GOWEN (*Jour. Gen. Physiol., 14 (1931), No. 4, pp. 447–461, figs. 2*).—A study of the rela-

tion of duration of life to the balance between sex chromosomes and autosomes in *Drosophila melanogaster* is reported. The duration of life in type females and triploids, in both of which a balance of the sex chromosomes and autosomes was maintained, was, respectively, 33.1±0.6 and 33.1±0.8 days. In the unbalanced groups, type males and sex intergrades, the duration of life was, respectively, 28.9±0.8 and 15.0±0.3 days. The elimination of other factors appeared to indicate that the lack of balance of the chromosomes was accountable for the differences in life span in the groups.

Metabolism as related to chromosome structure and the duration of life, J. W. Gowen (*Jour. Gen. Physiol., 14 (1931), No. 4, pp. 463–472*).—A study of the carbon dioxide production by the groups of flies on which the duration of life was reported in the above paper showed that those having the sex chromosomes and autosomes in balance produced carbon dioxide at a lower rate than those in which the chromosomes were out of balance. Cell size, as in triploids, was not directly related to metabolic rate.

Habit: The driving factor in evolution, E. W. MacBride (*Nature [London], 127 (1931), No. 3216, pp. 933–944, figs. 4*).—Evidence supporting the theory of evolution is presented, and the author endeavors to show that habit is the factor responsible for evolutionary changes.

The effects of breed on the growth of the chick embryo, T. C. Byerly (*Jour. Morph. and Physiol., 50 (1930), No. 2, pp. 341–359*).—Data on the growth of chick embryos of the Rhode Island Red and White Leghorn breeds and reciprocal crosses between them are presented. After the tenth day of incubation the embryos of the heavier breed and the hybrids were slightly heavier than the White Leghorn embryos, but in eggs of the same size the weight difference between the breeds tended to disappear at hatching due to the limitation of the food supply. The size difference is considered as more probably due to a difference in the proportion of the cells dividing at a given time than to a difference in the duration of mitosis.

The mortality of the hybrids was intermediate, but the percentage of monsters in the hybrids was less than in either of the pure breeds.

The effects of breed on growth of the embryo in fowls and rabbits, W. E. Castle and P. W. Gregory (*Science, 73 (1931), No. 1903, pp. 680, 681*).—The authors discuss the results presented in the above paper, and conclude somewhat differently from Byerly that the genetic constitution does influence growth rate and through it body size. Embryos of the larger breed appeared to grow faster, and crossbred embryos grew more rapidly than purebred embryos.

Litter size and latitude, C. B. Davenport (*Arch. Rassen u. Gesell. Biol., 24 (1930), pp. 97–99*).—Attention is called to the greater frequency of twins in human births and the larger sized litters in rodents born in colder climates than in warmer climates.

Developmental anomalies in a special strain of mice, C. H. Danforth (*Amer. Jour. Anat., 45 (1930), No. 2, pp. 275–287, figs. 4*).—A strain of mice has been established in which about 20 per cent of the living young show some degree of posterior duplication. The anatomy of the anomaly is described. In the same strain other anomalies have been noted which are designated as kinky tail, spontaneous localized hemorrhage, clubfoot, microphthalmia, tumors, etc.

The formation of the sex glands and germ cells of mammals.—V, Germ cells in the ovaries of adult, pregnant, and senile albino rats, G. T. Hargitt (*Jour. Morph. and Physiol., 50 (1930), No. 2, pp. 453–473, figs. 17*).—From a study of the ovaries of rats at different stages of pregnancy, during oestrum, and in sterile and senile females, it was found that new ova are produced

during adult life by single cells or groups of cells of the germinal epithelium enlarging and pushing into the tunica albuginea, where a young follicle is formed. The germinal epithelium of nonpregnant animals was most active, but there was some formation of new ova going on during pregnancy and even in senile animals.

Studies on the sexual cycle in birds, I–III (*Amer. Jour. Anat., 45 (1930), No. 2, pp. 289–305, figs. 16, pp. 307–343, figs. 16; 46 (1930), No. 3, pp. 477–497, figs. 20*).—Three papers in this series are reported.

I. *Sexual maturity, its modification and possible control in the European starling* (*Sturnus vulgaris*), T. H. Bissonnette.—A study of the normal sexual cycle in male starlings showed that the testes are very small in November and December, but increase slowly in size during January with a more rapid increase during March and April. During June and July regression in size begins and the winter size is again reached in September. Under experimental conditions it was found that extra exercise during the winter months did not induce the onset of spermatogenic activity, but that from five to seven hours of additional illumination daily from a 60-watt lamp caused a remarkable increase in testis size and spermatogenic activity. Complete spermatogenesis could be induced in about six weeks with the extra lights. Limiting the amount of light in the spring by shades caused a regression of the germinal elements.

II. *The normal progressive changes in the testis from November to May in the European starling* (*Sturnus vulgaris*), *an introduced, non-migratory bird*, T. H. Bissonnette and M. H. Chapnick.—Testes of wild starlings killed from November 16, 1926, to May 11, 1927, were studied. It was estimated that the testis volume increased about 1,504 per cent until late in April, after which there was a slight decrease. The lengthening daily sunlight period was more closely correlated with the changes in the testes than changes in temperature, nutrition, barometric pressure, or in other observed conditions. Three types of cells were observed in the tubules of the smallest testes. All of these were considered to be modifications of a single type. Interstitial cells were plentiful when germ cell activities were lowest. There appeared to be some correlation between the changes in the color of the bill and testis changes.

III. *The normal regressive changes in the testis of the European starling* (*Sturnus vulgaris*) *from May to November*, T. H. Bissonnette.—The characteristics of the testicles of starlings killed from May to November are described. Regressive changes occurred before the high summer temperature. The possibility is suggested that the habit of the males to sit on the eggs during incubation has some bearing on the regression.

The histological structure of the testes is described.

FIELD CROPS

[Agronomic studies at the Connecticut Storrs Station] (*Connecticut Storrs Sta. Bul. 171 (1931), pp. 4–8, figs. 2*).—In a study of factors affecting vigor of seed potatoes, early dug (immature) seed outyielded seed dug later when planted the following spring. It seemed probable that any increase in vigor was due to removing the crop from the field before infection had proceeded very far. Virus diseases again masked possible results due to the effect of plane of nutrition and nutrients, although the plats were rogued severely every year.

No increases in yields of marketable potatoes came from applying more than 750 lbs. of 10–16–14 fertilizer per acre, nor did broadcasting one-half the fertilizer when the rate was 1,500 lbs. or more influence yields appreciably.

Number of missing hills and rate of fertilization were correlated distinctly. On pasture land, long unfertilized except for 1 ton of limestone and 500 lbs. of superphosphate per acre, when nutrient elements were each broadcasted in commmercial fertilizers at various rates, omission of potash reduced potato yields appreciably more than leaving out nitrogen or phosphorus. The first 60 lbs. of potash increased the yield 50 bu. per acre, the second 37, and the third 11 bu., supporting earlier findings (E. S. R., 44, p. 529) that about 80 lbs. of potash was enough for the crop on the Charlton soil on the college farm. No yield increases came from more than 100 and 160 lbs. per acre, respectively, of either nitrogen or phosphoric acid.

In 1929, beginning the second 5-year period on the pasture improvement project (E. S. R., 61, p. 431), the relative productions of pasturage were for no treatment 100, superphosphate 228, superphosphate and limestone 315, superphosphate, limestone, and potash 325, superphosphate, limestone, potash, and nitrogen 342, superphosphate, potash, and nitrogen 298, and limestone and potash 138. The top-dressed limestone seemed to be affecting the reaction of the 2- to 4-in. but not the 4- to 6-in. soil horizon. In soils from plats receiving 1,000 lbs. of superphosphate there was 2.5 times as much phosphorus available in the 0- to 2-in. as in the 2- to 4-in. horizon and nearly 4 times as much as in the 4- to 6-in. level. Lime was indicated as quite important in any long-time pasture improvement project on the acid soils. Applying half the nitrogen in July rather than all in April resulted in less total pasturage for the season without affecting appreciably the distribution of the grazing.

Grown in jars of variously fertilized pasture soil, white clover and Kentucky bluegrass responded most to lime and phosphorus, while redtop grew practically the same regardless of treatment, suggesting why its close relative, Rhode Island bent, is so abundant in the run-down permanent pastures of northeastern United States. Biennial sweetclover was indicated as desirable for pasture either by itself or supplemental to permanent pasture. More and riper corn came from applying 125 lbs. per acre of 4–10–6 fertilizer in a 3 by 10 in. area around the seed than from 500 lbs. broadcasted.

[The progress of agronomic work in California] (*California Sta. Rpt. 1930, pp. 49–52, 58, 59*).—The progress of experiments with field crops is again reported on (E. S. R., 62, p. 727).

Annual forage crops leading in acre yields in tests by B. A. Madson and L. G. Goar included hairy vetch with oats at Delhi and peas with oats in the coast districts. Berseem clover might be of some value as a winter forage in coast districts where winters are mild. Fall-sown calcarata vetch for soil improvement in the Imperial Valley resulted in substantial increases in seed cotton. Guar and sesbania of the summer legumes gave best results as cover crops on the heavy soil of the valley. New high-yielding strains of Small White beans developed by hybridization were resistant to the high temperature of the San Joaquin Valley and similar regions.

Premature dying out of alfalfa studied by J. L. Weimer of the U. S. Department of Agriculture was determined to be due to a disease termed "alfalfa dwarf," which produces symptoms resembling those caused by the bacterial wilt organism *Phytomonas insidiosum*. Since the disease occurs on all types of soil, it is probably not due to a nutritional disorder, a conclusion confirmed by the failure of manure and commercial fertilizers to prolong materially the life of diseased plants. A mosaic disease of alfalfa found rather generally distributed in California causes a dwarfing and malformation of the leaves, and preliminary tests indicate that the virus is carried by aphids.

In further studies of the injurious after effects of sorghums on succeeding crops by J. P. Conrad and Goar, yields of small grain at Imperial were

somewhat better after Double Dwarf milo than after Heileman milo. Ammonium sulfate in 200-, 400-, 600-, and 900-lb. applications continued to increase the yields of barley and wheat following these milos. Applications from 35 to 65 days after seeding gave larger yield increases than equal quantities earlier or later. Legumes planted in strips across Heileman milo stubble and fallow showed much the better growth after fallow, contrary to results of similar tests at Davis. The acre yield of threshed barley at Davis after Acala cotton was 2,435 lbs., after Long Red mangels 2,625 lbs., and after Fargo Straight Neck milo 1,300 lbs. Barley yields following Double Dwarf, Heileman, and Fargo Straight Neck milos did not differ significantly. New strains of grain sorghum advanced by G. W. Hendry possess dwarfness, erect headedness, early maturity, and large white seeds.

Promising indications in breeding work with cereals by W. W. Mackie were corn varieties adapted to California and resistant to Fusarium, ear worm, and lodging; hybrid wheats highly resistant to stem rust; oats hybrids combining the desirable qualities of Kanota with the stem rust resistance of Richland; and barley strains from crosses between Sacramento, a barley resistant to mildew and smut, and Atlas, combining the desirable qualities of both. Poso, a club wheat derived from Little Club × Clarendon, was found in tests by G. A. Wiebe in cooperation with the U. S. Department of Agriculture to be from 10 to 14 days earlier than Little Club. It equals Little Club in milling and baking qualities and resembles it in habit of growth and general appearance. During three years at Davis the new variety showed a gain of 25 bu. per acre over Little Club.

Blue Rose Supreme rice was found by Mackie to make its highest yields at the Imperial Valley Substation when planted June 12 and Caloro and Edith July 3, the results showing that the medium and long grained rices can be grown successfully in the valley and that a high quality can be produced if precaution is taken to prevent checking when the crop is mature. Wild rice (*Zizania aquatica*) has been grown to maturity in several coast counties and in the Sacramento Valley.

Whether sugar beets were blocked when young (March 23 with from 2 to 4 true leaves) or later (April 26 with from 4 to 8 true leaves), in sugar beet investigations on peat soils on Staten Island, a delay of about 2 weeks in thinning gave better results than thinning at once or a delay longer than 2 weeks. Late blocking was superior to early blocking. In rows 18 in. apart with spacings of 4, 8, 12, and 16 in., the 8-in. spacing gave the highest yield of roots, sugar percentage, and yield of sugar per unit area. Indications were that beets on peat soil may profitably be spaced more closely than is usual on sediment soils. The highest yield in irrigation tests in cooperation with the U. S. Department of Agriculture, on King Island on peat soil where the height of water table was varied, occurred on the plat which had the lowest (4 ft.) water table and the second best yield with the next lowest (3 ft.) water table. The lowest sugar percentage occurred where the water table was kept nearest the surface.

Very early sowings, November and December, resulted in a high average weight of roots, high total yield of roots, a comparatively low percentage of sugar and stand, and a high percentage of bolters (30 to 50 per cent); early sowings, January and February, a lower average weight per beet than with earliest plantings, favorable yields because of better stands, higher sugar percentage, and very few or no bolters; and late sowings, March and April, the lowest total yield of roots because of lower average weight per beet, a stand and sugar percentage comparable to early planted beets, and no bolters.

When transplanted beets were only 4 to 5 in. long, the mature roots were short and showed excessive branching, whereas beets 8 in. long gave longer mature roots with less branching. Transplanting did not materially affect the average weight per beet nor the sugar percentage.

Strains developed from beets selected for resistance to curly top among diseased commercial beets showed that resistance is an inherent characteristic of many individual plants. In the strain P19 a consistent transmission of this character through five successive generations was observed.

[Farm crops work in Michigan] (*Michigan Sta. Bien. Rpt. 1929–30, pp. 27–32*).—Brief accounts are given of the results of variety tests with alfalfa (E. S. R., 63, p. 825) and root crops, planting tests with corn (E. S. R., 64, p. 363) and potatoes (E. S. R., 65, p. 433), breeding work with corn resistant to corn borer (E. S. R., 65, p. 433) and potatoes, spraying (E. S. R., 63, p. 35) and seed treatments (E. S. R., 63, p. 48) with potatoes, harvesting tests with fiber flax (E. S. R., 65, p. 224), and experiments with chlorates for weed control (E. S. R., 63, p. 37).

Compared with Wisconsin Pedigree No. 9, the leading 6-row barley in Michigan, Spartan (E. S. R., 61, p. 330), a new 2-row, smooth awn variety developed by the station, matured more plants and heads per row, had greater average weights per kernel and bushel, matured about 1 week earlier, and due to stiffer straw retained a larger percentage of heads at harvest. Iogold oats was early and highly resistant to stem rust in the Upper Peninsula.

In 1928, 45.1 per cent of the alfalfa flowers artificially tripped produced seed pods and flowers developing naturally 15.8 per cent. In 1929 the respective percentages were 55.4 and 12.1. In both seasons the artificially tripped flowers produced more seed per pod. Conditions seemed most favorable for natural tripping and fertilization from 11.30 a. m. until noon. Lack of proper pollination appeared to be the chief factor limiting alfalfa seed production in Michigan.

When white beans must be left in the field two weeks or longer after ripe, it was evident that smaller loss would result from pick and shattering if the beans were left standing until they could be harvested. Some sorts shattered much worse than others, the Robust variety retaining its beans unusually well under adverse conditions. The larger vine varieties produced the greater yields and the lighter pick, and, with one exception, tended to shell less in the field.

Cultural tests with beans at the station and with corn at Augusta showed that weeds were controlled most efficiently by using the rotary hoe three or four times when weed seedlings appeared above ground, and following once or twice with the duck foot shovel cultivator. Weed control and yields were not as good with the rotary hoe alone. The rotary hoe is least likely to injure beans when it is not used until mid-forenoon after the turgidity of the beans has been reduced by evaporation.

Applications of 500 lbs. of common salt per acre to sugar beets resulted in better stands and increased yields, especially where a fertilizer high in potassium was also supplied. Sugar beets were transplanted by machinery at about the same cost as the ordinary seeding, blocking, and thinning operations, and one hoeing was eliminated. The transplanted beets yielded about one-third more than sugar beets seeded at the same time, but were a little less satisfactory in shape than beets grown directly from seed.

[Agronomic investigations in the Virgin Islands, 1930], J. B. THOMPSON and M. S. BAKER (*Virgin Islands Sta. Rpt. 1930, pp. 2, 3, 10–14, 15, figs. 3*).—Breeding work and variety tests with sugarcane, sweetpotatoes, and cotton, and

trials of miscellaneous grasses and legumes for forage and legumes for green manure are again reported on (E. S. R., 63, p. 130).

Sugarcane varietal leaders in sugar content per acre of plant cane included S. C. 12/4, 7.06 tons; S. C. 22/21, 6.73; S. C. 26/102, 6.63; P. O. J. 2379, 6.6; S. C. 26/81, 6.51; and S. C. 26/150, 6.37 tons. Leaders in sugar yield on the plats during the past 6 years included S. C. 12/4, S. C. 22/21, P. O. J. 228, P. O. J. 979, Uba 796, and Uba 797. Kassoer led in cane yield, but its sugar yield was low. Many promising seedlings have been obtained. A relatively large proportion of those seedlings having for a parent S. C. 12/4, a vigorous stooling cane, have been found to produce large canes ranking high in sucrose content. Sun-dried sugarcane seed, hermetically sealed with a little calcium chloride in 1-qt. fruit jars, after remaining 60 days was found to be viable and germinated when planted. The heaviest yields of Crystallina cane were had on spacings of 60 by 30 in., whereas S. C. 12/4 made its best crops on 42 by 42 in. spacings.

Of the sorghums, feterita and Early Orange sorgo gave the highest forage yields and kafir the heaviest grain crop. The grain yield ranged from 0.98 to 2.5 tons per acre, and the yield of green forage from 3.26 to 12.88 tons. Cowpeas, velvetbeans, and pigeon peas continued to give the best results among legumes tested. Three cuttings of alfalfa at 35-day intervals yielded from 6 to 12 tons of green forage per acre. Arizona common yielded the highest and Grimm the least. Dallis grass, Bahia grass, Jaraguá grass, molasses grass, and Igoka grass were promising among introduced grasses. Molasses grass proved adapted to local weather conditions.

Further work with green manure crops tended to confirm previous results, indicating that sunn hemp, jack bean, cowpeas, pigeon peas, and the velvetbean might profitably be used for green manuring purposes in the Virgin Islands. Hubam clover and a native legume, *Canavalia maritima*, were also of merit.

[Green manure crops and forage grasses], J. M. Westgate and M. Takahashi (*Hawaii Sta. Rpt. 1930, pp. 5, 6, figs. 3*).—Green manure crops making best growth at the lower altitudes were in order Mauritius velvetbean, pigeon pea, jack bean, *Crotalaria anagyroides*, *C. incana*, *C. saltiana*, sunn hemp (*C. juncea*), papapa bean (*Dolichos lablab*), pega-pega (*Desmodium cajanifolium*), and *Meibomia resonii*, while at the Haleakala Substation, elevation 2,160 ft., the blue lupine and pigeon pea grew better. Although none of the green manures bore satisfactorily at the higher elevations, apparently due to cold, wet weather prevailing during growth, most of them produced excellent seed crops at the lower elevations, 50 to 100 ft. The more popular forage grasses were Mexican grass (*Ixophorus unisetus*), Napier grass, Merker grass, kikuyu grass, and Rhodes grass.

Percentage dry matter and field weight of ear corn from unlimed and limed plots, A. W. Blair (*Jour. Agr. Research [U. S.], 42 (1931), No. 11, pp. 773, 774*).—Corn grown on variously fertilized acid sassafras loam of fair quality at the New Jersey Experiment Stations, did not mature and dry out quite so early as corn grown on the same soil with a fair supply of lime. From general averages some difference also was indicated in favor of the limed plats when field weight of ear corn was considered.

The order, rate, and regularity of blooming in the cotton plant, C. K. McClelland and J. W. Neely (*Jour. Agr. Research [U. S.], 42 (1931), No. 11 pp. 751–763, figs. 4*).—The blooming of plants of several varieties of cotton was studied at the Arkansas Experiment Station in 1923 and 1929 and at Marianna Ark., in 1929.

Cyclic tendencies observed in blooming in grouped plants are explained as due to the tendency toward regularity in individual plants. The fact that th

breaks in the flowering curves are irregular and not pronounced is held due to conditions upsetting regularity in individual plants, to the blooming of these plants on different dates, and to injuries and shedding. The horizontal interval of blooming varied on an average less than 0.4 from a 6-day interval and increased consistently at outer nodes of fruiting branches over the intervals between nodes nearer the central stem, i. e., the early intervals are shorter than the later ones. For the vertical order of blooming the average was generally within the range 2.3 to 2.8 days. The vertical interval usually decreased at the outer nodes. The ratio between the horizontal and vertical blooming periods varied greatly but usually was between 2.6 and 2.1.

Vigor of growth as shown by number of flowers per plant seemed to exercise a small influence in reducing the length of the blooming intervals. A comparison of data taken at the station (1,450 ft. altitude) with those from Marianna (200 ft.) indicated a lengthening of the blooming intervals, horizontally, due to greater altitude and lower temperatures. However, the vertical intervals were shorter in Delfos and Express and slightly lengthened in Trice at the higher altitude.

Review of data of all workers showed but slight differences in rapidity of blooming due to difference in species, variety, altitude, latitude, season, or various cultural practices. While it appeared almost impossible to make cotton bloom rapidly, the number of blooms per plant or per row or per day might be increased by increasing the size of the plant.

Oats production in western Oregon, D. D. HILL (*Oregon Sta. Bul. 285 (1931), pp. 24, figs. 2*).—Cultural methods and field practices are outlined for oats in western Oregon, and information is given on the status of the crop in the State, its adaptation, soils, plant diseases, weeds, and on oats varieties and their yields, quality, and milling values.

Western Oregon produces about 85 per cent of the 200,000 to 300,000 acres of oats grown in Oregon for grain, and almost all of the 200,000 acres of oats grown for hay. The oats and wheat acreage of western Oregon declined during the past decade, and the barley acreage increased. Victory, Three Grain, and Eclipse, the highest yielding spring oats in the station trials, could well replace most of the other spring oats varieties currently grown in western Oregon. Gray Winter, the only winter oats variety recommended, gives in the north coast area the highest yields from both fall and spring planting. Oats produced in western Oregon were found to be of good quality and high in test weight, that of the better spring varieties averaging about 37 lbs. per bushel and of Gray Winter oats about 40 lbs.

Analyses of spring varieties grown in different years and on different soils showed few significant differences in composition. Victory had a lower crude fiber content and a slightly higher total energy value than Three Grain or Eclipse. Winter varieties were significantly higher in energy value than the spring oats, being much lower in crude fiber and higher in total fat. In feeding value Gray Winter oats was about 10 per cent higher than average spring oats.

Oat varieties for northeastern Wyoming, R. S. TOWLE (*Wyoming Sta. Bul. 181 (1931), pp. 11*).—Markton and Gopher oats outyielded other varieties in tests made on dry land since 1917 at the Sheridan Field Station in cooperation with the U. S. Department of Agriculture. Markton led midseason oats in 6 of the 7 years since it was introduced in 1924 and averaged highest during the period 1924–1930. Sixty Day led the early varieties until Gopher was included in the tests in 1927.

Preliminary report on cultural and fertilizer experiments with rice in Arkansas, M. NELSON (*Arkansas Sta. Bul. 264 (1931), pp. 46, figs. 2*).—Rice experiments from 1927 to 1930, inclusive, at the Rice Branch Experiment Station east of Stuttgart included variety and seeding tests, weed control studies, comparison of cover crops and green manures, and fertilizer trials.

The highest yielders of 14 rices studied were in order Early Prolific, a medium grain variety, 58.2 bu., and Caloro Japan, a short grain rice, 57.3 bu., both maturing in about 125 days, and Supreme Blue Rose, a medium grain sort requiring about 150 days or longer to mature, 57 bu. Edith, with 47 bu. and Mortgage Lifter with 46.9 bu. were good yielding long grain varieties. Yield did not appear to be related closely to the time required for maturity.

For most varieties the practical seeding period extended from April 20 to June 25, with from May 15 to 31 appearing preferable. When sown on different dates over 85 days, varieties differed markedly. For example, when sown in early April, Supreme Blue Rose used 170 days and in early July 122 days, whereas Fortuna lacked the power of adjustment and did not mature satisfactorily when seeded after June 15. When recleaned seed was drilled at acre rates of from 5 to 16 pk., the 6-pk. rate gave the highest average yields. The higher rates made denser stands with fewer weeds but with the lower acre yields.

Weed control methods tested involved a number of cultural and irrigation practices. Fallowing reduced weed infestation and increased yields by about 650 lbs. per acre but at the expense of a rice crop every other year. Small yield decreases followed shallow and deep irrigation, mowing, and rolling. Deep irrigation was quite effective with barnyard grass, and rolling controlled some sedges. Intermittent irrigation had some advantages in weed control. Immediate submergence controlled weeds to a certain extent, but satisfactory stands were hard to obtain with this practice. Rotation with soybeans seemed to be the best method for weed control and resulted in substantial increases in rice yield. Based on yield increases, cultivated soybeans were better than soybeans drilled solid and uncultivated or those planted late after late tillage.

Cover crop trials gave indications that rye, hairy vetch, and crimson clover with winter drainage might be grown with moderate success, while winter oats and Austrian winter peas would succeed in mild winters. Early plowing had some advantage in yields, especially with rye making heavy growth. Such rye plowed under late resulted in much straighthead and reduced yield.

Fertilizer treatments, involving most objectives in fertilizer practice, employed on weed infested land almost invariably resulted in a marked increase in growth of grass and weeds and somewhat lower yields of rice than on the unfertilized checks. The loss in yield from all fertilizer treatments for all seasons averaged 5.74 bu. per acre. Ammonium sulfate was slightly better than other nitrogen sources. Yields of rice receiving basic slag were depressed more than by other sources of phosphorus. Addition of lime to the fertilizer generally resulted in small yield increases. Although some increases in yield were noted when the fertilizer application was made 3 and 4 weeks after seeding they were not consistent, and weeds also increased under these practices.

The potato in Alaska, H. W. ALBERTS (*Alaska Stas. Bul. 9 (1931), pp. 1[illegible] figs. 3*).—Production practices are outlined for potatoes, the most important agricultural crop in Alaska, specific information being given on the history, soils, cultural and storage practices, varieties, crop hazards, and production and prices for the southwestern, southeastern, and interior divisions of Alaska.

An investigation of the quality of Illinois grown wheat, R. W. STA[illegible] (*Illinois Sta. Bul. 371 (1931), pp. 265–327, figs. 6*).—Investigation of the composition and the milling and baking quality of numerous varieties of wheat grow[illegible]

on experimental plats in northern, central, and southern Illinois was made over the period 1922–1926. Some samples of farm-grown wheat also were tested.

Of the hard wheats grown at Urbana in central Illinois, Minnesota Reliable and Michikof most consistently produced loaves of good size and texture, while many other hard varieties yielded flour of inferior strength, and no soft wheat grown for three years or longer averaged better than medium in strength. Most samples from the DeKalb plats in northern Illinois produced strong flour. Minnesota Reliable most consistently made loaves of large size and excellent quality. Blackhull too made an excellent record, in marked contrast to the Blackhull grown at Urbana, where only the 1926 crop yielded strong flour. Although wheat grown at DeKalb averaged considerably lower in protein content than did the same varieties at Urbana, it was decidedly superior in baking quality. No one wheat grown on the Alhambra field in southern Illinois was notable for strength of flour. While a few loaves of excellent size were produced, they usually were medium to inferior in size. Mediterranean, Marvelous, and Illini Chief led in varieties tested for two years or longer. The hard wheats, Ilred and Blackhull, scarcely equaled the better soft varieties in strength of flour.

No conclusive evidence was had that any of the five varieties tested were consistently superior to the others in protein content and baking strength when grown on any particular group of soils on 13 fields in several counties of southern Illinois. In Christian County all wheat varieties grown on black clay loam on clay were much higher in protein content, and nearly all were decidedly greater in strength of flour than those grown on gray silt loam on clay.

Of 62 samples of wheat obtained from farmers in southern Illinois, 27 per cent made loaves of good size and the rest loaves of medium or inferior size and often with pale crusts which were lumpy or split. Of 73 samples representing car lots shipped from central Illinois to St. Louis and Indianapolis, 4 of 36 samples of hard wheat produced loaves of good size, 2 of 18 samples of soft wheat made loaves of good volume, and 1 of 19 samples of mixed wheat made flour of good strength.

In protein content all samples of hard red winter wheat grown on the several experimental plats and samples representing car lots shipped from central Illinois to terminal markets averaged only slightly greater than soft red winter wheat from the same sources. However, in average loaf volume the hard wheat materially surpassed the soft wheat.

As to quality of varieties of hard spring wheat, Kota at Urbana ranked first in baking strength, with a 3-year average of 14.45 per cent protein and an average loaf volume of 2,035 cc., and was followed in order by White Australian, Marquis, and Illinois No. 1. Loaves of Illinois No. 1 were medium to small in size and usually inferior in quality. During the same period (1924–1926) at DeKalb, Marquis led with flour of excellent strength.

Successive crops of hard red winter wheat produced from seed grown in the hard red winter wheat section of the country, according to the limited data, did not deteriorate progressively under Illinois conditions. Hard spring wheat grown in Illinois from North Dakota seed sometimes equaled or even exceeded in protein content and loaf volume the northern-grown seed, depending on season and quality of the original seed.

Conclusions from the investigation in brief were that environmental conditions ordinarily existing in central and southern Illinois are not conducive to the production of winter wheat, either hard or soft, which mills into strong flour. The baking quality of the flour milled from the winter wheat from

rthern Illinois usually can be counted on to be good to excellent. A few rieties of winter wheat seem to maintain ability to produce flour of good iality, in spite of unfavorable environmental conditions of central Illinois. ard spring wheat of high protein content which will mill into flour of excellent rength may be grown in both central and northern Illinois. "It seems scarcely robable that Illinois can consistently compete with the West and Northwest the profitable production of high-grade bread wheats. Since, however, there a large demand for soft-wheat flour for other purposes than yeast-lightened read, future investigation may well give special attention to soft wheat."

An instrument for determining the breaking strength of straw, and a reliminary report on the relation between breaking strength and lodging, S. C. Salmon (*Jour. Agr. Research [U. S.], 43 (1931), No. 1, pp. 73–82, fig. 1*).—The instrument described and illustrated was used from 1926 to 1930 o test the breaking strength of straw of different varieties of wheat grown at he Kansas Experiment Station. The straw of soft wheats showing resistance o lodging usually was more difficult to break than that of hard wheats which odge easily. The straw of varieties intermediate in tendency to lodge was intermediate also as to breaking strength. Correlations between lodging in various seasons were not significant statistically, but those between breaking strength of straw in different seasons were both high and quite significant. This anomaly was explained by the fact that the percentage of lodging was governed by weather conditions, growth stage, and variations in individual estimates to a much greater extent than is breaking strength determinations. The instrument described may be of value in selecting new wheat varieties resistant to lodging by accurately measuring the breaking strength of their straw.

Methods of reducing the cost of wheat production, H. H. Finnell (*[Oklahoma] Panhandle Sta., Panhandle Bul. 29 (1931), pp. 3–16*).—A number of practices which may be used alone or collectively to increase wheat yields or lower unit costs and are applicable on heavy soils in the High Plains within 100 miles of Goodwell are indicated, largely from experiments in wheat production reported on earlier from the station. These include rotation with other crops, especially cultivated row crops, which leave a minimum of organic residues in the soil, summer fallowing only in extreme cases, vigorous weed control during the period of preparation, deep tillage not oftener than once in two years but at least every four years, use of available farm manures applied to hay crops in rotation with wheat but never directly on the wheat, construction and maintenance of level terraces to retain and distribute run-off water for crop production, and the use of productive adapted varieties.

West Virginia weeds, H. K. Rowley (*West Virginia Sta. Circ. 59 (1931), pp. 35, figs. 27*).—Descriptions and control methods are given for 28 of the weeds most troublesome in field crop production in West Virginia, with general information on weed propagation and eradication. Control of quack grass by chlorate sprays has been noted elsewhere (E. S. R., 65, p. 635).

HORTICULTURE

[Horticulture at the California Station] (*California Sta. Rpt. 1930, pp. 39–43, 85–88, 95, 96, 97, 98, 101–104*).—Marked differences were observed in the growth of orange, lemon, and grapefruit trees propagated on different rootstocks. Observations on 387 Washington Navel orange trees grown from buds of a single parent tree and worked on sour orange seedlings of recorded size and character showed a high correlation, $+0.736\pm0.016$, between the size of the seedling and the size of the nursery tree at the end of the first year, with a lesser correlation, $+0.487\pm0.028$, at the end of the eighth year. Correlations of

$+0.622 \pm 0.021$ and $+0.517 \pm 0.025$ were, respectively, determined between size of 1-year-old trees and size at 8 years and with total 5-year yields. Seedlings below normal size at budding almost invariably produced dwarfed, low yielding trees. Eliminating such from the population greatly reduced the correlation coefficients, suggesting the practical value of discarding these seedlings in propagation. Orchard studies showed that lemon trees on sour orange are generally smaller but not necessarily poorer than those on sweet orange or grapefruit. Progenies grown from rootstocks of good and poor type lemon trees did not differ in vigor or type, whereas scion progenies from good and poor lemon trees did vary widely. None of 11 different forms of citrus used for inarching unthrifty lemons on sour stock improved the condition of the trees at the end of 4 years, and when the original tree was girdled the 3 inarched supports failed to maintain the tree. Lemon trees propagated from cuttings and planted in 1927 made satisfactory growth.

Citrus fertility studies, begun in 1927 in an orchard which had been treated uniformly during the 10 years from planting, showed the value of turned under cover crops or other organic matter, even in the face of supplied nitrogen either as urea, nitrate of soda, or calcium nitrate. The best treatment was an annual application of 3 lbs. of nitrogen per tree, half derived from stable manure. In 1929 the yield of oranges was no greater from trees receiving from 2 to 3 lbs. of nitrogen from stable manure and urea than from 1 lb. from the same materials; in fact, trees receiving 0.5 lb. of nitrogen yielded as well in 1930 in many cases as did trees receiving 1 lb. One-half lb. of nitrogen per tree yielded over twice the fruit in 1930 that was obtained from no cover crop, no fertilizer trees and over three times the fruit from winter cover cropped (purple vetch) trees. Apparently where the supply of nitrate nitrogen was low, winter cover crops reduced yields. Straw mulch in moderate quantities plus supplemental nitrogen gave fair results, but in large quantities apparently reduced yields. No effect was noted from phosphorus or potash or both on trees, fruit, or cover crops. Periodic determinations of moisture, nitrate nitrogen, total nitrogen, organic carbon, and acidity were made which showed the carbon-nitrogen ratio to be essentially the same in all plats. Some losses of nitrates were noted as a result of leaching.

In the Rubidoux experiments the regular growing of winter legumes improved the condition of the trees. Twenty-three annual applications of phosphorus and potash have had no visible effects, even on the cover crops. In cooperative experiments in the Coachella Valley heavy applications of nitrogen, phosphorus, and potash had no apparent effect on date palms. Applications of sulfate of iron to Valencia oranges badly affected with mottle leaf restored the trees to normal appearance. A thin coating, largely of calcium carbonate, was found on the roots of the unthrifty trees. In experiments in the San Joaquin Valley, growing Sudan grass in orange orchards hastened the coloring of the fruit, a fact which could not be associated with the depletion of phosphorus, potassium, nitrates, or moisture.

As reported by W. H. Chandler, ferrous sulfate was the only substance found beneficial in the control of little leaf of fruit trees, and apparently continued applications were necessary to maintain the health of the trees. No evidence was found of injury from the chemical, even in large quantities.

L. H. Day found that a 1⅝ per cent solution of copper nitrate in denatured alcohol and water was a promising disinfectant for treating wounds made in combating bacterial gummosis.

As determined by L. D. Davis, split pit and gumming of peaches were apparently decreased by late thinning of the fruits.

Attempts by Davis and W. P. Tufts to identify the rootstocks of mature pear trees met with but little success.

E. C. Hughes failed to influence the ripening of apricots by injecting sugar solution into the soil.

O. Lilleland was unable to control die-back of prune trees in the Sacramento Valley by applications of chloride or sulfate of potash. However, the trees so treated were the best in the orchard. Analyses of ripe prunes gave no indication that trees abundantly supplied with potash produced fruits of higher sugar content than control trees. The potash content of the soil (water soluble and replaceable) decreased markedly with the depth of sampling in practically all of the orchards. Lilleland studied the growth of stone fruits and concluded that the size of the crop is not responsible for the depressed period of growth which follows the initial rapid development of the fruits.

Some evidence was obtained by R. W. Hodgson that the open vase form of training persimmon trees may be the more desirable way of handling this species. Staking the trees seemed to lessen their inherent ability to withstand winds.

Inbred lines of the Klondike watermelon were developed and disseminated for trial. Wilt-resistant watermelons from the Iowa Experiment Station were found promising, and selections from Klondike also possessed resistance. Certain seedlings from crosses between Cucumis varieties and strains immune to powdery mildew gave promise.

Cytological studies of the annual larkspur variety Exquisite Pink revealed irregularities in meiosis and probably explain why that variety is not found in a homozygous state. Observations on the growth of gladiolus corms stored at different temperatures and planted at different dates showed that low storage temperature delays the initiation of blossoming, but that high temperatures are unsafe for long continued storage.

Male asparagus plants continued to outyield the female, but produced smaller and poorer spears.

Of 51 Hunisa × Muscat grape seedlings developed by F. T. Bioletti and E. B. Babcock, 22 bore very dark red, 8 dark red, 1 light red, and 20 white fruits. Thirty-three had the firm texture of the Hunisa parent. Grape thinning studies by A. J. Winkler showed that in varieties which tend to set straggly clusters or shot berries or both, decreased pruning with flower cluster thinning gave the greatest improvement in quality. The amount of wood retained at pruning should vary inversely with the number of straggly clusters or shot berries usual to the variety. With varieties that set very good clusters with short spur pruning, longer spurs increased yields and also the quality if the amount of fruit was limited by thinning. Varieties that set well filled clusters of normal berries with normal pruning were most benefited by cluster thinning. Flower cluster thinning of such varieties tended to induce too dense and rather oversized clusters. Berry thinning of varieties with a tendency toward too dense clusters improved quality. In Muscat, 16 leaves were required to nourish satisfactorily a cluster with 40 berries.

In work with the Tokay and Malaga grapes Winkler found that berry thinning improved quality and aided materially in harvesting and packing. In Tokay the gain in rate of harvesting from thinning ranged from 22 to 100 per cent.

H. E. Jacob, studying the effects of girdling on the grape, found a relative increase in carbohydrates above the wounds during the period they were open with a tendency to equalization following healing.

Winkler found that a combination of the Balling degree and the Balling acid ratio was a better index to the quality of the grape than was the Balling degree alone.

P. F. Nichols and H. M. Reed found a direct correlation between the texture and color of the flesh of dried prunes and the specific gravity and the weight per volume of the fruit. Either or both tests in conjunction with sorting are deemed reliable indexes to quality. Natural drop or light shaking gave better quality prunes than did hard shaking, and dry plats yielded slightly better fruit than those under irrigation. Dehydration was better than sun drying.

[Horticulture at the Hawaii Station], J. M. Westgate, M. Takahashi, J. C. Ripperton, C. Richter, E. V. Harrold, and W. T. Pope (*Hawaii Sta. Rpt. 1930, pp. 8, 9, 15–17, 24–35, figs. 8*).—Observations on lettuce seedlings obtained as a result of hybridization showed unexpected segregation in some cases and unexpected stability in others.

Studies on the composition of Macadamia nuts indicated that the stage of maturity apparently has a greater influence on composition than does climate, soil, or seedling variation. Oil apparently increased and sugar decreased until the outer hull turned brown. Grading according to the specific gravity of the unshelled nut did not prove entirely satisfactory because of the great variation in the thickness of the shells. Thin shelled nuts with a specific gravity of less than 1 contained some marketable kernels. Correlating specific gravity, which ranged from 0.96 to 1.05, with oil content, there was found a close relationship. Mature nuts when cooked in oil yielded a light brown, mild flavored product, whereas immature nuts gave an undesirable product. The approximate division line between desirable and undesirable nuts was at a specific gravity of 1, equivalent to an oil content of about 70 per cent. Nuts with a specific gravity above 1 did not appear satisfactory for roasting. It is believed that two distinct varieties of Macadamia nuts exist in Hawaii, differing in appearance of the shell, in oil and sugar contents, and incidentally in flavor. Considerable variation was observed in Macadamia nuts both in the tree and in the fruit. Some trees bore unusually large nuts and some thin shelled nuts. Considerable difference was noted in vigor, nature of the foliage, time of flowering, and productivity.

Six raspberries, Lloyd George, Cuthbert, Herbert, Seneca, Latham, and Ranere, were imported for breeding and cultural studies. A native raspberry, *Rubus hawaiiensis*, attaining a height of from 8 to 10 ft. and bearing very large juicy fruits of either yellow or purple color, is discussed.

In citrus studies it was found that pomelo seedlings of the large-fruited shaddock type make the best rootstocks for most kinds of citrus in Hawaii. In 10 months the seedlings grew 14 to 18 in. and were satisfactory for grafting. Quality of citrus fruits was found to be greatly influenced by temperature and moisture prevailing during development. Notes are presented on a large number of miscellaneous fruits under test.

[Horticulture in the Virgin Islands], J. B. Thompson, C. L. Horn, and W. M. Perry (*Virgin Islands Sta. Rpt. 1930, pp. 3, 7–10, 16, 17, 18, figs. 4*).—Yield data are presented for a small planting of Cavendish bananas set out in 1925, and the returns are given for shipments of tomatoes, eggplants, peppers, and onions sent to New York City. Varietal notes are given upon avocados, mangoes, dates, and lemons. For the control of pustule scale (*Asterolecanium pustulans*) of fig a 2 per cent paraffin oil emulsion applied at intervals of 60 days was the minimum treatment for effective control.

Promising results were secured on St. Thomas and St. John with Muscat of Alexandria grapes. A heavy yield of Bermuda onions was obtained, but late

rains caused a high percentage of splitting and doubling. Fair success was attained in the production of Marglobe tomato seed.

A method for studying water conduction in plants in relation to pruning, grafting, and other horticultural practices, E. M. Harvey (*Oregon Sta. Bul. 279 (1931), pp. 26, figs. 8*).—A modification of the dye method of studying the path of water movement in plants is presented and discussed. By applying suction at the basal end or at a side branch located near the base a dye solution was drawn backward through the stem. Only dyes of an acid nature were found to penetrate the xylem satisfactorily, the best dyes being aniline blue, amaranth, acid or light green, acid fuscin, trypan blue, methyl blue, eosin, tartrazine, and ponceau red. In normal uninjured branches the dye flowed both away from and toward the point of suction but regularly through the xylem which constituted the individual unit of the branch receiving the dye. The effects of pruning wounds caused by the removal of medium sized and scaffold limbs on dye movement is discussed. The effects of type of crotch, age of the tissue, of water shoots, and of various superficial wounds, such as canker, gummosis, and implement wounds are outlined. Apparently in grafts the developing buds on the scion exert a strong influence on the cambial activity of the stock, causing the xylem elements to be directed chiefly toward the support of the scion.

A new strain of pickling cucumber (*Michigan Sta. Bien. Rpt. 1929–30, p. 40*).—The successful development by intensive breeding of a new strain of pickling cucumber with characteristics appealing to the commercial packer is noted.

Characteristics associated with abortion and intersexual flowers in the eggplant, O. Smith (*Jour. Agr. Research [U. S.], 43 (1931), No. 1, pp. 83–94, pls. 3, fig. 1*).—Studies at the Oklahoma Experiment Station showed that the amount of flower abscission in general parallels the amount of flowering and is little influenced by seasonal temperature. Counts on 238 Black Beauty inflorescences showed from 1 to 5 blossoms, with 2 as an average. Practically no blooms dropped from the 1-flowered inflorescences, while 82 per cent of the total drop came from the 2- and 3-flowered groups. Practically all of the abscising blooms had short, poorly developed styles and small pedicels. As a group, the diameters of the pedicels were directly correlated with the lengths of the styles on these pedicels. Anther size apparently was not affected by the diameter of the pedicel. There was noted a direct relation between the small size of pedicel, small phloem area in the pedicel, and weak expression of femaleness. Histological studies of short-styled and normal-styled flowers at the time of anthesis failed to show any degree of parallelism between stuntedness of the styles and the degree of degeneration of ovules and embryo sacs.

In a study at Cornell University with eight varieties of eggplants the author observed that some varieties rarely bear more than one blossom per inflorescence, and in these the percentage of abortion was small. Black Beauty, on the other hand, behaved much the same at Ithaca as in Oklahoma.

A preliminary report on the vegetative growth of okra (Hibiscus esculentus Linn.) in relation to the production of varying amounts of reproductive tissue, E. M. Harvey (*Oregon Sta. Bul. 284 (1931), pp. 19, figs. 8*).—Studies of the growth response in okra plants, from a part of which (A) the fruits were removed when from 10 to 12 days old, part (B) when fruits were from 4 to 5 days old, part (C) when fruits were removed 24 hours after the opening of the bud, and part (D) with buds taken off 24 hours before normal time of opening, showed the greatest total retardation of growth in lot A, with

others arranged in sequence. However, the relative retardation between lots was not uniform because, for example, the first 4 days of fruit development proved a more severe drain on the plant than did the next 5 days. Although the number of flowers produced per day by each okra plant was very small, 0.06 to 0.36, the large size, rapid development, and probable high metabolic activity seemed to make the flowers highly effective in influencing growth. Increasing the nitrogen supply caused rapid growth and less fruiting. The removal of fruit from the high-nitrogen plants apparently retarded growth temporarily.

In general conclusion the author asserts that the okra plant manifests an extremely delicate balance between vegetative and reproductive activities, which, coupled with large flowers and uniform habit of flowering, makes the species highly desirable for physiological studies on the growth-reproduction problem, especially for work in southern regions more naturally adapted to okra culture.

Shelterbelts and fruits, A. L. Nelson (*Wyoming Sta. Bul. 179 (1931), pp. 23, figs. 27*).—General information is presented on the planting and care of shelterbelt and fruit trees, discussing such details as soil preparation, spacing of trees, choice of species and varieties, subsequent care, etc.

Progressive changes in the waxlike coating on the surface of the apple during growth and storage, K. S. Markley and C. E. Sando (*Jour. Agr. Research [U. S.], 42 (1931), No. 11, pp. 705–722, figs. 3*).—Analyses of the waxy cuticle of summer, autumn, and winter varieties of apples harvested at various stages of growth and during storage at 32° F. showed that in general there is an increase in ursolic acid, oily fraction, and total ether extract during the growing period and in storage. The oily fraction increased more rapidly than did the ursolic acid, accounting for the progressive increase in the percentage of the oily fraction in the total ether extract with advancing maturity. The authors believe that changes in the physical properties of the natural waxy coating, such as permeability, undoubtedly accompany the shift in the ratio of oily fraction to ursolic acid. In general larger quantities of ursolic acid and total ether extract were obtained from the shady side than from the exposed side of a single apple, but there was no appreciable difference in oily fraction, with the result that the percentage of oily fraction in the total ether extract was lower on the shady side. Considerable variation was found in the values for ursolic acid, oily fraction, and total ether extract in a single variety from year to year and between varieties in any one year.

Removal of spray residue from apples, W. S. Hough, R. H. Hurt, W. B. Ellett, J. F. Eheart, and A. B. Groves (*Virginia Sta. Bul. 278 (1931), pp. 16, figs. 6*).—Studies of arsenical residues and methods of removal indicated that the time of applying sprays is an important factor in residue reduction. Arsenicals applied during the first half of July may leave an excessive amount of residue if followed by dry weather, whereas those applied late in July were quite certain to cause excessive residues, irrespective of weather. Approximately one-half the residue was found on the open surface of the apple and the other half in the calyx and stem ends.

Wiping or brushing removed about one-third of the total arsenic, whereas washing in dilute hydrochloric acid consistently removed excessive residues. One gal. of fresh water applied through nozzles was required to remove traces of acid from each bushel of washed fruit. The towel method of wiping and drying washed fruits proved more satisfactory than air drying, because the towel also removed leafhopper specks and other superficial blemishes. When packed in barrels and baskets washed apples kept as well as unwashed fruit.

The stone cells of pear fruits, especially the Kieffer pear, J. W. Crist and L. P. Batjer (*Michigan Sta. Tech. Bul. 113 (1931), pp. 55, figs. 21*).—Of

various possible factors, such as nature of the graft, age and vigor of tree, climate, fertilizer treatment, size of fruit, defoliation, ringing, puncturing the epidermis, and covering the fruits with black cloth, which might contribute to the formation of stone or grit cells in the pear, only the last two had any apparent influence, both increasing the quantity of the cells. From the results of cytological studies, stone cell formation is deemed a process of regular lignification, consisting in a heavy layer thickening of the walls of the ordinary parenchymatous cells. The stone cells were found to be concentrated in clusters about the carpels individually and the core as a whole, thinning out toward the periphery and again concentrating in the subepidermal tissues. The manner of clustering, arrangement, and quantity were sufficiently constant to distinguish varieties. The authors believe that enzymes are actively concerned in stone cell formation, peroxidase being most abundant in Kieffer, a variety with many stone cells. Other enzymes, such as carboxylase and lignase, are considered possible factors.

Stone cells contribute to the firmness of the fruit, aid in healing and preventing wounds, determine in part the length of the growing period, and influence quality through their influence on texture and on the nature and concentration of chemical constituents determining sweetness and flavor. The existence of stone cells in the pear is believed to rest on generic and varietal heredity, and any improvement of gritty pears, such as Kieffer, is deemed to lie in genetic recombinations.

Preliminary report on the effect of irrigation on major berry crops in the Willamette Valley, C. E. Schuster, R. S. Besse, G. L. Rygg, and W. L. Powers (*Oregon Sta. Bul. 277 (1931), pp. 51, figs. 16*).—This paper is presented in two parts, the first of which discusses the results of studies of the irrigation of certain small fruits and the second offers practical suggestions on irrigation for the grower.

Despite greater production costs in all cases, irrigation, with one exception, that of the Ettersburg 121 strawberry, increased yields and returns. With the Evergreen blackberry the net income during a 3-year bearing period was increased threefold as compared with nonirrigated plants; with red raspberries the net income was doubled; with loganberries irrigation returned a substantial profit, whereas nonirrigated berries netted a loss; with black raspberries yields and returns were increased by irrigation but not to a profitable degree; and with the Marshall strawberry irrigation doubled the net income. Irrigation increased the size of Evergreen blackberries 30 per cent, red raspberries 7 per cent, loganberries 35 per cent, and black raspberries 22 per cent. Irrigation hastened the ripening of the Evergreen blackberry and Ettersburg 121 strawberry, did not influence the ripening of the red raspberry, and slightly retarded maturation of loganberries and of Marshall strawberries. With respect to the quality of the canned product, irrigation had no appreciable effect on red or black raspberries but did improve the quality of loganberries.

Fertilizers and soils in relation to Concord grapes in southwestern Michigan, N. L. Partridge and J. O. Veatch (*Michigan Sta. Tech. Bul. 114 (1931), pp. 42, pl. 1, figs. 7*).—Working in a vineyard the soil of which is described as low or only medium in natural productivity and somewhat variable in depth of the surface layer, evidence was secured that applications of nitrogen increased growth and production and that the addition of phosphate or potassium gave further increases amounting to from one-half to three-fourths of the nitrogen response alone. The greater portion of the increased production from fertilizers was associated with greater growth, with some indication that vines receiving nitrogen alone were slightly more productive than unfertilized vines of equal

growth. Vines receiving phosphorus and potassium in addition to nitrogen seemed slightly more productive than vines of equal vigor with nitrogen alone. Vines which were weaker at the beginning of the experiment gave the larger proportionate increases in yield and thereby tended to decrease the variability in production between vines; yet the stronger vines retained their lead throughout the experiment. Applications of fertilizer gave relatively small increases the first year, the greatest benefit coming later from increased vine growth.

Significant differences in response of vines to fertilizer could not be associated with differences in the thickness of the humus layer or with variations in the permeability of the subsoil. Variations in depth of the humus layer were apparently in part the result of erosion. Subsoil variations were chiefly with respect to the ratio of clay to sand. The soil phases were not definitely marked but intergraded with one another, and the roots of a single vine often penetrated several phases. Variations in thickness of the humus layer had more influence on vine growth and production than did any other single soil factor.

Experiments with fertilizers on coconut palms and variation in palm productivity, T. B. McClelland (*Porto Rico Sta. Bul. 34 (1931), pp. 23, pl. 1, figs. 15*).—Inconsistent results obtained in fertilizer experiments in three coconut plantations differing in age led to the general conclusion that no particular element or combination of elements can be recommended on the basis of these trials. The striking fact brought out in the experiments was the wide variation in production of individual palms of the same age and receiving the same cultural and fertilizer treatments. This variability is believed to rest upon inherent differences in the palms. Producing capacity was manifested early in the life of the palm, the high yielders generally maturing early. The importance of choosing productive parents for future plantations is stressed.

The palms in the youngest plantation were apparently benefited by fertilizers, since all the treated plants outyielded the untreated one. In the intermediate aged group naturally low producing palms were apparently benefited by fertilizer treatment, with little or no effect on the productive palms; yet no consistent differences were found in favor of any one treatment. The same inconsistencies prevailed in the oldest group of palms. No correlation was observed between nut size and fertilizer treatment. Common salt apparently gave favorable results on the youngest group of trees but showed no benefit upon the intermediate aged.

China aster seed treatment and storage, W. O. Gloyer (*New York State Sta. Tech. Bul. 177 (1931), pp. 41, figs. 5*).—Pathogenic fungi found infesting aster seed included *Septoria callistephi*, *Ascochyta asteris*, *Fusarium conglutinans callistephi*, *Botrytis cinerea* type, *Pleospora herbarum*, and *Alternaria* spp. Of various methods tested for disinfecting aster seed, the use of a 1–1,000 mercuric chloride solution proved most effective and safest. The seed was first soaked for 30 minutes in water at 100° F., then 30 minutes in the mercuric chloride, following which it was rinsed and dried. Evidence was obtained that 100° is necessary to insure killing of Septoria spores, and where lower temperatures are employed it may be necessary to spray the seed bed with weak Bordeaux mixture. Liquid and dust treatments with organic mercury compounds were not as effective as was the mercuric chloride solution. Semesan dust added to stored aster seed exerted no effects.

The moisture content of aster seed changed readily with that of the surrounding air, and under conditions of high humidity the seed gradually lost viability and mycelia developed on the surface. Freshly harvested seed rapidly lost its newness under conditions of high humidity. Aster seed stored in sealed

jars in a warm room kept viable for four years or more, much longer than in concrete storage. Septoria on celery and other seeds are deemed controllable in the same manner.

FORESTRY

[Forestry at the California Station] (*California Sta. Rpt. 1930, pp. 69–72*).—By means of thermocouple measurements the temperature of the stems of coniferous seedlings was determined at the soil surface and showed that when temperatures exceeded 130° F. injury was quickly apparent, irrespective of the species. Small seedlings with tall stems and few cotyledons succumbed more quickly than did sturdy seedlings with many cotyledons. In the latter the injury was more often confined to an area on the sunny side of the stem. Quite evidently direct insolation was a factor of great importance in causing the death of the smaller plants.

In a taper study of western yellow pine it was found that the board foot contents of the trees overran values given in the preliminary tables, that only thrifty, mature trees fitted the hyperbolic equation of tree form suggested by Behre (E. S. R., 58, p. 441), and that 20 years after partial cutting in the virgin stand the remaining trees had not shown any significant change of form.

In logging and milling studies, it was observed that it was not essential to follow the same logs through the entire process but that desired information could be obtained from a series of data. In lumbering operations with redwood, it was determined that not more than 50 per cent of the potential merchantable volume of an average redwood stand is actually utilized due to various natural and man-caused losses.

The artificial reseeding of cultivated forage crops was found to fail, largely because of the use of wrong species, poor preparation of the seed bed, poor sites, and too early grazing. The last apparently inhibited the development of the plants, both root and top. It was found that roots normally resumed growth about 15 days following top removal, whereas the top regenerated directly at a greatly accelerated rate for the first 24 hours, with gradual slowing down until a substantial new top had formed.

[Forestry at the Michigan Station] (*Michigan Sta. Bien. Rpt. 1929–30, pp. 35, 36*).—Studies of the soil preferences, rates of growth, and pulpwood value of white spruce, black spruce, and balsam as grown in northern Michigan indicated that on favorable sites black spruce compares very favorably in rate of growth with the more popular white spruce. Black spruce apparently grew best on well drained, fine sandy loam and poorest on poorly drained Rifle peat. Black spruce grows naturally in very dense stands, which should on suitable soil produce profitable yields.

Carolina poplar showed much promise as a species for arresting the movement of shifting sands, sometimes growing from 6 to 8 ft. per year, even though the root crown was buried 6 ft. deep. Willow also gave good results, both species standing much hardship and being suitable as first-line defense and protection for conifers which make but little growth the first years on blow sand. Directions for establishing windbreaks are presented.

A study of woodlot conditions in a township in Ionia County showed that less acreage was devoted to woodlots in 1930 than in 1912 and that less wood was used for fuel. However, practically all of the timber cut was converted into fuel wood.

The use of polymorphic curves in determining site quality in young red pine plantations, H. Bull (*Jour. Agr. Research [U. S.], 43 (1931), No. 1, pp. 1–28, figs. 7*).—In studies conducted by the Connecticut State Experiment

Station in red pine plantations averaging 17 to 18 years of age, anamorphic site index curves were found to introduce large errors because they misrepresented the actual trends of growth. The author believes that accurate site index curves for red pine can not be constructed mechanically from a single graduating curve, but that when a polymorphic series of site index curves was constructed from seven graduating curves the actual and marked change of trend in progressing from the poorest to the best site was clearly manifested. Whereas anamorphic curves indicated that the period of maximum height growth occurs at the same age on all sites, polymorphic curves showed that the period of maximum height growth occurs much earlier on the better sites and that there is no constant relation between heights for any two indexes of the same age. Anamorphic curves for red pine based on any classification age gave too high readings on good sites and too low on poor sites below the classification age. Even with polymorphic curves, small plats less than 30 years old can be site indexed with sufficient accuracy only to the nearest full foot (at 15 years). The younger the stand the more difficult it is to obtain accurate site indexes. Red pine indexes (at 15 years) under Connecticut conditions ranged from 7 to 22 ft., averaging 17 to 18 ft. A new method is presented for determining site index, even when the exact total age is unknown.

Forest rangers' catechism: Questions and answers on the national forests of the California region, R. W. Ayres and W. I. Hutchinson (*U. S. Dept. Agr., Misc. Pub. 109 (1931), pp. IV+48, pl. 1, figs. 13*).—Information in the form of questions and answers is presented on the location, management, utilization, recreational facilities, fire-control practices, etc., in the national forests of the California region.

Christmas trees as a cash crop for the farm, F. H. Eyre (*U. S. Dept. Agr., Farmers' Bul. 1664 (1931), pp. II+17, figs. 10*).—General information is presented on desirable species, establishing the plantation, cultivation and care, protection, harvesting and marketing, etc.

DISEASES OF PLANTS

[Plant pathology studies at the California Station] (*California Sta. Rpt. 1930, pp. 43–46, 53, 54, 83–85, 97*).—The sun blotch disease of the avocado was found capable of transmission by grafting. Sun blotch symptoms appear related to the vigor of the new growth. The disease is believed to be an infectious chlorosis.

Copper sulfate applied to the soil was found effective in the control of the decline trouble of the Deglet Noor date. The "fool disease" of dates of the Old World was studied and found associated with a carbonizing dry rot of the surfaces of the embryonic leaves in the bud. The direction of growth of the bud frequently changed from vertical to nearly horizontal, or the bud was entirely killed. A disease supposedly similar to the Old World malady khamage was found destroying inflorescences before the spathe opened.

A study of a surface breakdown occurring on the fruit of oranges after a rather extended rainy period in the winter season revealed no fungi on most of the younger spots, although Alternaria and various common molds were noted on older lesions. The trouble seemed to be most severe on oil-sprayed trees but was not confined to these. Abscission of grapefruit following prolonged rains was apparently due to the weather rather than defective culture. Studies of organisms that might cause citrus blast, taken from Citrus, lilac, and Prunus, showed marked similarity in growth and pathogenicity except that on lemons at high temperatures the Citrus isolations produced the much larger lesions.

Crown rot of walnuts decreased during the past two years, except in over-watered orchards and in isolated trees where old infections were still rampant. The failure of symptoms to become evident until the tree was girdled made treatment difficult. Some evidence was obtained that walnut stocks differ in their susceptibility. Pear blight, found abundant in southern California on loquat, quince, and other members of the pear family, was found capable under conditions of artificial infection of attacking the succulent tissues of walnut.

A disease of the avocado, challenge spot, was found to be nonparasitic but likely due to a water deficit in the tree and fruit. Apoplexy of the avocado was also attributed tentatively to water deficiency.

For the control of cantaloupe mildew it was advised that plants be treated if winter squash had been grown on the adjacent land. Cantaloupes in the hot interior valleys were unable to endure treatment with sulfur.

Delayed foliation of many fruit trees occurred in the spring of 1930, but numerous southern varieties of peaches fruited normally. Peaches of the saucer type decayed badly because the skin often cracked before maturity, allowing organisms to enter.

Studies upon *Puccinia coronata* indicated that the species differs from *P. graminis* in several respects. It is preferentially heterothallic but can probably reproduce homothallically. Difficulty was met in preparing the aecia of *P. dispersa* for microscopic study because the vacuoles of the leaf cells contain a stainable, probably mucilaginous substance which causes the cells to shrink badly during xylol treatment.

Goldcoin, Banner Berkeley, Martin, and White Odessa wheats were found to contain one dominant factor for resistance to *Tilletia tritici*. The factor in Goldcoin, Banner Berkeley, and possibly in White Odessa is deemed identical with that in Martin. Hussar had two factors for resistance to bunt. Crimean wheat C. I. 3055 and Turkey wheat C. I. 1558 had one factor similar to that in Hussar for resistance to bunt. Ceresan did not prove as effective as copper carbonate for the control of bunt. Ceresan, copper carbonate, and copper sulfate all gave satisfactory control of covered smut of barley.

The so-called die-back of the apple, occurring mainly in Sonoma County, appeared to be correlated with certain physical and chemical soil conditions rather than due to any parasitic organism. A number of new hosts for pear blight were found among ornamental shrubs. Application of copper sulfate to the soil and also by insertion into the tree gave very effective improvement of prune, pear, and other fruit trees affected with exanthema. Similar treatment with copper sulfate and other chemicals gave no benefit in the control of diamond canker of French prunes.

Spores of *Sclerotinia sclerotiorum*, the causal fungus of apricot rot, were found present throughout the winter on all sorts of vegetation. The importance of insects as carriers of diseases causing fig decay was established. A new disease, apparently of a virus nature, was observed on the Globe artichoke. Varietal tests showed the Iron, Brabham, and Virginia Black-eye varieties of blackeye beans to be highly resistant to *Fusarium vasinfectum tracheiphilum*. Evidence was found that the causal agent for beet mildew (*Peronospora schachtii*) is carried in and on the seed. Fields planted from clean root beds were much freer of mildew than those established from badly infected beds.

Studies were undertaken upon the virus diseases of the potato which showed that practically all forms are present in the State. Certain comments are made on virus diseases, including the fact that climatic conditions in various localities greatly influence the development of characteristic symptoms.

Inbred lines of onion were apparently more susceptible to pink root disease than were their parents. Individual bulbs within a variety apparently differed in resistance. The degree of soil infection was apparently positively correlated with the severity of the attack. The Sweet Spanish onion was slightly more resistant than other varieties, and leeks were slightly susceptible.

[Plant pathology studies at the Michigan Station] (*Michigan Sta. Bien. Rpt. 1929–30, pp. 12–16, 32*).—Pointing out that even careful roguing of potato fields may fail to eliminate virus diseases under conditions of high temperature, drought, and other unfavorable weather conditions, mention is made of the tuber index method of testing seed stocks and thereby developing disease-free or nearly disease-free stocks.

Some progress was made in the development by selection in the field of Fusarium wilt resistant strains of John Baer, Grand Rapids Forcing, and Nellist Ideal tomatoes. Over 100 isolations of the organism were gathered from different parts of the State for comparison and inoculation tests.

In preliminary experiments on the control of diseases of fruits evidence was seen of a very definite relation between the length of periods of high humidity and the effectiveness of standard fungicides.

In studies of cereal diseases both *Tilletia foetens* and *T. tritici* were found, although most of the stinking smut was caused by the former. Comparisons of formaldehyde, copper carbonate, and organic mercury dusts as control agents showed them about equally effective, but because of injury the dusts are deemed safer, especially on wheat. Preliminary experiments in the control of stripe of barley and spot blotch of barley and oats indicated that organic mercury dusts are better and safer control media than is formaldehyde. Observations on 140 new strains of wheat developed by the farm crops section showed 34 highly susceptible to stinking smut, with considerable resistance in the other 106. Berkley Rock and Red Rock wheats had 3 and 25 per cent of infection, respectively.

Of gladiolus diseases it was found that scab may be controlled by rotation and corm treatment. On sandy soils the disease is almost self-eliminating, while on heavy soils rotation and corm treatment are necessary. Immersion for two hours in corrosive sublimate, 1–1,000, was the most effective treatment for corms. Dry rot (*Sclerotium gladioli*) did not yield readily to corm treatment, but was checked by treatment, rotation, and use of light soils.

Chlorosis of an infectious nature found in rose houses was controlled only by roguing diseased plants from the propagating beds. Root knot, found the major cause of the nonblooming of peonies, was fairly well controlled by immersing the roots in water at 120° F. for 30 minutes.

Unfavorable growing weather in 1929 and 1930 induced the development of celery yellows and afforded a chance to select resistant plants in the susceptible Golden Plume and French Golden Self Blanching varieties. Two related forms of Septoria are believed responsible for the late blight of celery, one attacking the petioles as well as the blades, the other the blades alone.

In bean disease work there were investigated two apparently distinct types of mosaic, a classical or mottle type found on the pea bean and the rugose form found only on the Refugee bean. Micrococci were found to be rather constantly associated with the mottle type disease and are generally absent from plants free from mosaic. Cultures made from young seed taken aseptically from pods produced on plants diseased from seed yielded cultures of micrococci in approximately the expected ratio of the transmission of virus through the seed. The conclusion is presented that micrococci are at least closely associated with the virus in the plant, and cytological studies showed them responsible

for the destruction of the chloroplasts in the cortical parenchyma of the petioles and in the leaves. In rugose mosaic a very pleomorphic organism was observed in the chloroplasts of the leaves, and a similar organism was isolated and grown in culture. Apparently rickettsial forms were observed in its life history.

Phytomonas vignae, the causal organism of bacterial spot of the Lima bean, was found to overwinter in the soil. Infection of the cotyledons with frequent loss of the plants was found due to the same organism.

Studies of corn planting and corn seedlings indicated that earlier planting was feasible, and that enzymatic activity was probably concerned with the rate of growth of stems. Hollow heart of potatoes was associated with planting distances and nutrient conditions.

Of various disinfectants tested for the control of scab and black scurf of potatoes, corrosive sublimate gave the best results. Seed treated with corrosive sublimate averaged approximately 10 per cent better yield and 15 per cent less scurf than that treated with hot formaldehyde and most of the mercury compounds. For scab control little difference was noted between the various disinfectants. Sulfur applied to the soil slightly reduced yields and gave no appreciable control of scab. Application of lime and fresh stable manure decidedly increased scab.

Field mycology, E. J. GILBERT (*La Mycologie sur le Terrain. Paris: E. Le François, 1928, pp. 183+[1]*).—This condensed account, volume 2 of the series Les Livres des Mycologue, deals with aims, methods, and results of a study of mycology as applied under the conception of ecology, the main headings being the station and its factors analytically considered, fungi in the station, and species under natural conditions. The bibliography contains 16 titles by 12 authors.

Further agglutination tests with phytopathogenic bacteria, G. K. K. LINK, A. E. EDGECOMBE, and J. GODKIN (*Bot. Gaz., 87 (1929), No. 4, pp. 531–547*).—In the course of these investigations, designed to extend those previously noted as shared by Link (E. S. R., 60, p. 545; 62, p. 235) or as made by Sharp (E. S. R., 60, p. 545), the authors state that *Bacterium campestre*, *B. X*, *B. cucurbitae*, *B. pruni*, and *B. translucens undulosum* were differentiated by direct agglutination tests with their antisera. Cross agglutination so high that differentiation by the direct agglutination test was not possible occurred between antisera of *B. phaseoli* and the heterologous organisms *B. X*, *B. cucurbitae*, *B. translucens*, *B. translucens undulosum*, and *B. Z*, between the antisera of B. *Y* and *B. campestre*, between the antisera of *B. translucens* and *B. translucens undulosum*, and between the antisera of *B. Z* and *B. translucens undulosum*. Further related information is detailed.

The exploratory studies of this and antecedent papers are said to indicate that the agglutination test may find a use in phytobacteriology analogous to its rôle in other fields of bacteriological study. For some organisms the direct agglutination test apparently can be developed to serve in identification of species and strains; for others absorption of agglutinins would have to be employed. These studies also give promise that the agglutination and absorption of agglutinin tests can be used in grouping and classification of at least some closely related forms of phytopathogenic bacteria, though more detailed and penetrating work would be required.

Interesting and significant also are the observations including evidences of variation which have been obtained. Study of this phenomenon of variation promises to become itself an interesting field, in which serological methods may prove as useful as they have been in the study of variants in bacteria other than plant pathogens.

An analysis of the effects of Diplodia infection and treatment of seed corn, T. A. KIESSELBACH and J. O. CULBERTSON (*Jour. Agr. Research [U. S.], 42 (1931), No. 11, pp. 723–749, fig. 1*).—The effects of seed infection with Diplodia were determined by a statistical comparison between plants grown from infected and healthy seed. The two lots differed distinctly with respect to germination, the healthy material showing 91 and 89 per cent viability in the laboratory and field, respectively, as compared with 72 and 52 per cent for the diseased lots. Disinfection of diseased seed increased the field stand by 36 per cent but had no effect on the healthy lot. The more severe effects of the infection noted in the field as compared with the laboratory are attributed to the injury to young sprouts before emergence from the soil. Under the occasional condition necessitating the use of infected seed, disinfection is advised accompanied by the use of more than the usual quantity of seed.

Diplodia curtailed the development of some of the surviving plants to the extent of reducing height 2 to 3 in. and of increasing the variability of the growing population. Such differences practically disappeared before maturity. There was no greater percentage of diseased mature ears on plants from infected than from healthy seed. Diplodia may have caused a possible reduction of 1 per cent in mean grain yield and a slight increase in the variability of individual plant production.

Varietal resistance, physiologic specialization, and inheritance studies in bunt of wheat, E. N. BRESSMAN (*Oregon Sta. Bul. 281 (1931), pp. 44, figs. 9*).—At least 10 forms of bunt, 6 belonging to *Tilletia levis* and 4 to *T. tritici*, were determined on the basis of pathogenicity on host wheats of known resistance and by certain physicochemical tests. In addition the presence of other physiologic forms not readily differentiated with the host wheats utilized was apparent. Collection 9, one of the most virulent, was obtained in an important wheat-growing section in eastern Oregon. Although no direct evidence was obtained that the physiologic forms recently determined were imported, such a possibility is conjectured.

Although *T. levis* is more common east and *T. tritici* more abundant west of the Rocky Mountains, no real significance is attached to this distribution, form differences being deemed more significant than species differences. Turkey × Bearded Minnesota 48 was the only wheat to prove highly resistant to all forms of bunt used. Varieties such as Martin, White Odessa, Albit, Regal, Hussar, Banner Berkeley, and Ridit were found quite susceptible to one or more forms of bunt, indicating that inheritance studies should deal with specific forms of bunt and with pure lines of wheat. White Odessa, Albit, Martin, Regal, and Banner Berkeley contain the same genetic factor for bunt resistance, and in addition Banner Berkeley and Regal may contain modifying factors for resistance. Hohenheimer and Ridit should be included in a breeding program designed to obtain resistance to all the established forms of bunt. Pure lines of bunt differing in their virulency were developed by selecting single smutted heads.

Bacterial wilt of alfalfa, J. S. WIANT (*Wyoming Sta. Bul. 177 (1931), pp. 20, figs. 11*).—A description is presented of the disease organism and of its effect on the alfalfa plant, and the difference between diseased plants and those suffering from winter injury is indicated. The factors affecting the introduction and spread of alfalfa wilt and the ways and means of control are discussed.

Progress on experimental work with the transmission of bean mosaic, T. G. FAJARDO (*Phytopathology, 18 (1928), No. 1, p. 155*).—An artificial method of transmission involving a modified leaf mutilation has yielded from 80 to 100 per cent of mosaic infection. Field and greenhouse cage experiments during

1926 and 1927 proved conclusively insect transmission, success being attained with three species of mosaic-reared aphids and mealybugs and failure resulting in the case of leafhoppers, twelve-spotted and striped cucumber beetles, red spider, thrips, tarnished plant bug, and white fly. Transmission through soil failed, as did also infection on contacts of certain parts.

As regards the question of seed transmission, overwintering occurs commonly in the infected seed and in no other way so far as is known, the percentage carrying infection ranging with the variety as high as 50 per cent in commercial seed of susceptible varieties. Plants grown from infected seed yielded infected seed in higher percentages than did plants infected during their vegetative development, but in blossoming plants no infection of seed produced occurred in pods setting previously to inoculation. On uniformly diseased mosaic plants less infection occurred in late than in early set pods.

Studies on sclerotia and mycelial strands of the cotton root-rot fungus, C. J. King, H. F. Loomis, and C. Hope (*Jour. Agr. Research* [*U. S.*], *42* (*1931*), *No. 12, pp. 827–840, figs. 4*).—Under favorable conditions for growth, it was found that cotton root rot could be communicated to healthy plants by inoculations with sclerotia. Lethal conditions for sclerotia were air drying for 1.25 hours in an open room or desiccator and immersion for 15 minutes in water at 46° C. Sclerotia retained 81 per cent viability after 92 days in distilled water and 20 per cent viability after 121 days. When both simple sclerotia and sections of infected roots were placed in the center of jars of sand, 43° for 2 to 4 minutes sufficed to kill the sclerotia, while 51° was needed to destroy the mycelium of the root tissues. A 1–1,000 mercuric chloride solution killed individual sclerotia in 4 to 5 minutes, whereas with a 1–2,000 solution 30 minutes were needed. Sclerotia placed in soil which had been treated 1 to 6 days previously with 1 and 1.5 per cent formalin solution were killed. Mycelium on cotton roots was killed within 4 days but not 6 days after formalin treatments.

New sclerotia were developed by budding from old cultures, apparently thus prolonging the life of the fungus. In glass tubes of moist sand, root strands grew 10.5 ft. in 149 days. Sclerotia tended to develop on the strands shortly after they advanced beyond a fresh food supply. The ability of strands to grow through long tubes of sand three times in succession without resterilizing indicated that no toxic substance is left from the mycelium. Isolations of the fungus differed in vigor of growth and ability to develop sclerotia in large numbers, and these differences are suggested as the underlying cause of spotted infections in the field. Some evidence was seen of staling in old root rot cultures maintained for long periods on artificial media.

Some results obtained from the sulphuric acid treatment of cotton seed, G. W. Nye (*Empire Cotton Growing Rev.*, *6* (*1929*), *No. 1, pp. 50–52*).—Summarizing results obtained from a small field trial of the sulfuric acid treatment of cottonseed in Uganda, the author reports that confirmation has been obtained of the increase in germination percentage and rapidity under laboratory conditions. The acid shows no adverse effect on the aftergrowth or on the produce. This treatment is usefully applicable when only small quantities of seed are to be used, and it might also prove useful when resowings are objectionable. In addition to the advantages in sterilizing the seed, an opportunity is given to remove, in the floating seed, most of the dead and weakly ones.

Some conditions determining potato-seed-piece decay and black leg induced by maggots, R. Bonde (*Phytopathology*, *20* (*1930*), *No. 1, p. 128; Maine Sta. Bul. 357* (*1930*), *p. 236*).—Adults of the seed corn maggot (*Hylemyia cilicrura*) did not infect potato seed pieces by direct contact, but their eggs yielded maggots which induced decay in damp chambers and also induced rapid decay after entering wounds caused by various fungi and bacteria. Similar

activity was noted for the seed potato maggot (*H. trichodactyla*). Negative results were secured with the house fly, false crane fly, a fungus gnat, and with *Drosophila* spp. *Bacillus phytophthorus* and some of the potato pathogenes were isolated from the inside of the puparia of the seed corn maggot.

Effect of seed-potato treatment on yield and Rhizoctonia in northeastern Maine from 1925 to 1928, E. S. Schultz, L. O. Gratz, and R. Bonde (*Phytopathology, 20 (1930), No. 1, pp. 47–64, fig. 1; abs. in Maine Sta. Bul. 357 (1930), pp. 235, 236*).—Of a considerable number of treatments tested at the Aroostook Farm for the control of Rhizoctonia, cold and hot corrosive sublimate were among the most effective. Hot formaldehyde gave as good control as did cold formaldehyde. In general the organic mercury compounds were not as effective as corrosive sublimate. Seed with abundant sclerotia often produced fairly clean crops, but at other times clean seed gave much better results. Yields secured by the use of organic mercury compounds compared favorably with those obtained from corrosive sublimate and formaldehyde treated stock.

A reduction in seed-piece decay and an increase in stand were some of the most important benefits from seed treatment. On the other hand, some of the treatments under certain conditions reduced yields.

Net necrosis versus stem-end browning in Aroostook potatoes, D. Folsom (*Amer. Potato Jour., 7 (1930), No. 9, pp. 251–256; abs. in Maine Sta. Bul. 357 (1930), pp. 237, 238*).—Plantings of tubers showing typical net necrosis and stem-end browning yielded 99 and 6 per cent of leaf roll, respectively, the latter being just about the percentage from nondiscolored seed. The cause of stem-end browning is not known, the amount varying from season to season. Leaf roll rarely caused net necrosis in Irish Cobbler and Spaulding, and in Green Mountain did so only in some of the tubers produced by plants growing from healthy seed and infected with the disease during the growing season and after some months or weeks in storage.

The cabbage maggot as a disseminating agent of bacterial rots in the Cruciferae, R. Bonde (*Phytopathology, 20 (1930), No. 1, p. 128; Maine Sta. Bul. 357 (1930), pp. 236, 237*).—All rotted turnips were found to be maggot injured, and the injury, caused by *Hylemyia brassicae*, was always accompanied by a soft white rot. Maggot injury of Chinese cabbage was followed by a rapid soft rot. In rutabagas, bacteria pathogenic to turnip, cabbage, and potato were found only near maggot trails. Pathogenic bacteria were found in wild mustard and wild radish only near maggot paths. Maggots secured from wild radish roots induced bacterial decay in turnip and kohlrabi but not in potato. Pathogenic bacteria were obtained from the inside of puparia and mature flies, the pathogenes being apparently *Bacillus carotovorus*, *B. phytophthorus*, and *Bacterium campestre*.

An Actinomycete the cause of soil rot or pox in sweet potatoes, J. F. Adams (*Phytopathology, 18 (1928), No. 1, p. 152*).—Investigations conducted during six years on the cause of pox or soil rot of sweetpotatoes have shown that *Actinomyces* sp. is the pathogene rather than *Acrocystis batatae*, said to have been reported by Halsted in 1890 (E. S. R., 2, p. 416), or the slime mold *Cystospora batata*, said to have been descriptively reported by Elliott in 1916 (E. S. R., 36, p. 544). This pathogene has been isolated from typical pox lesions as well as demonstrated to be present in the lesions by histological methods, and direct inoculations have shown it to be pathogenic on sweetpotato slices, on root points emerging from fleshy, primary, and secondary roots, and on stems of sprouts, the resulting lesions simulating those occurring under field conditions. This Actinomycete was also pathogenic on slices of white potato, beet, and turnip but negative on carrot and dahlia. The optimum temperature in

relation to growth and infection ranged between 30 and 37° C., with slight development at room temperature. Cultural and inoculation studies gave negative results with *Actinomyces poolensis*, but *A. scabies* was pathogenic on cut slices and rootlets of the sweetpotato and white potato.

Local lesions in tobacco mosaic, F. O. Holmes (*Bot Gaz.*, *87* (*1929*), *No. 1*, *pp. 39–55*, *figs. 11*).—Nicotiana species found to develop necroses wherever tobacco mosaic virus of the common field type was successful in entering the leaf tissues were *N. rustica*, *N. langsdorffi*, *N. sanderae*, *N. acuminata*, and *N. glutinosa*. Local lesions developing in *N. rustica* can be used to measure accurately the potency of tobacco mosaic virus. Local lesions in *N. glutinosa* developed with exceptional rapidity, appearing sometimes in 30 hours and showing good development in 4 or 5 days. The large numbers that appear on a plant allow comparisons to be made between virus samples. A standardized method for using *N. glutinosa* as a test plant for ascertaining the concentration in samples of mosaic virus gives as rapid and accurate results as does the determination of bacterial numbers by plating methods.

The rots of Washington apples in cold storage, F. D. Heald and G. D. Ruehle (*Washington Col. Sta. Bul. 253* (*1931*), *pp. 48*, *figs. 13*).—The results are presented of a study of various apple storage rots arranged in order of their importance in Washington and according to generic relationships of the causal organisms. Of the 40 odd species belonging to 22 genera, 2 belong to the Phycomycetes, 2 to the Ascomycetes, 1 to the Basidiomycetes, and all the others to the Fungi Imperfecti. Several of the forms considered were capable of causing complete decay of fruits in cold storage, but the majority simply produced spots, several of the bull's-eye type. Rots enter apples in three general ways, (1) through mechanical injuries, (2) through necrotic or seminecrotic spots, and (3) through the unbroken skin. The rôle of temperature in the onset and progress of decay is discussed, and practical suggestions for preventing and reducing decays are presented.

A peculiar freezing trouble of pears in cold storage, H. Hartman (*Oregon Sta. Bul. 282* (*1931*), *pp. 8*, *figs. 2*).—A form of injury characterized by a glassy water-logged appearance on the outside and water-logging and drying of definite areas in the interior was experimentally induced in ripe, partly ripe, and firm green Anjou pears by subjecting them to 27 and 23° F. for six weeks and then thawing at 32°. At four weeks the amount of injury was slight at both temperatures. At 10° no such injury occurred from any length of freezing up to six weeks since all the fruit broke down completely upon thawing.

A preliminary report on Anjou scald and its control, H. Hartman (*Oregon Sta. Bul. 280* (*1931*), *pp. 8*, *figs. 2*).—Stating that Anjou scald differs from common pear scald in being more superficial but nevertheless detracting decidedly from the appearance of the fruit, the author reports the results of trials with four type of wrappers, using fruit from a single tree stored at 31° F., shipped to New York City, and there ripened at 65°. Under the conditions, Anjou scald was effectively controlled by the use of oiled wraps with and without copper sulfate added. Plain wraps with and without calcium hydroxide were not successful. No harmful effects traceable to the oiled wraps were noted.

A bacterial disease of barberry caused by Phytomonas berberidis, n. sp., H. H. Thornberry and H. W. Anderson (*Jour. Agr. Research* [*U. S.*], *43* (*1931*), *No. 1*, *pp. 29–36*, *figs. 5*).—The results are presented of a study of the bacterial leaf spot disease of the barberry, here designated as *P. berberidis*, which causes darkened water-soaked spots to appear on the leaves, petioles, and young shoots and in severe attacks defoliates the terminal shoots. The disease was observed

on several species, including *Berberis vulgaris*, *B. thunbergii*, *B. regeliana*, and *B. brevipaniculata*. The causal organism was isolated from *B. thunbergii* and successfully transferred to *B. thunbergii* and *B. vulgaris* by inoculation. The morphology and cultural aspects of the organism are described and discussed.

The identity of Phoma pitya Sacc., Phoma abietina Hart., and their relation to Phomopsis pseudotsugae Wilson, M. Wilson and G. G. Hahn (*Brit. Mycol. Soc. Trans., 13 (1928), pt. 3–4, pp. 261–278, pls. 4*).—Having attacked the alleged confusion regarding the relations to each other of species of Phoma reported as parasitic on the Douglas fir and other conifers, and the relation of certain forms to the parasitic fungus *Phomopsis pseudotsugae*, the authors state that *Phoma pitya* was found upon examination of the type specimen to be a Sclerophoma. This fact required that the name of the fungus be changed, and it has accordingly been fully described as *S. magnusiana*. *P. abietina* is now considered to belong to the genus Phomopsis and is described as *P. abietina*. *P. pseudotsugae* is declared, on the basis of sharp differences obtained by cultural studies, to be distinct morphologically and physiologically from *Phoma abietina*.

Phomopsis pseudotsugae is a true parasite of the Douglas fir and other conifers, killing young shoots and terminals and cankering larger branches and trunks. *Phoma abietina* causes canker constrictions of the smaller branches of Abies, though it has not been recorded as on Douglas fir or any tree in Great Britain. *S. magnusiana* is supposed to be saprophytic only.

ECONOMIC ZOOLOGY—ENTOMOLOGY

Glimpses of familiar birds, W. H. Carr (*New York: S. Gabriel Sons & Co., 1931, pp. [2]+157, figs. 147*).—Accounts are given of 72 of the land birds commonly occurring east of the Rocky Mountains, excluding birds of prey. A colored plate accompanies the description of each form. The egg of each is also illustrated in colors.

Additions to the list of birds known to be parasitized by the cowbirds, H. Friedmann (*Auk, 48 (1931), No. 1, pp. 52–65*).—The data here presented supplement the contribution previously noted (E. S. R., 61, p. 848).

Annual report of the department of biology for the year ending June 30, 1930, T. C. Nelson and E. B. Perkins (*New Jersey Stas. Bul. 522 (1931), pp. 47, figs. 15*).—In the first part of this report (pp. 5–24) Nelson deals with studies of the movements and distribution of oyster larvae in natural waters of New Jersey. The mode of formation of a zone of sharp transition in salinity, the halicline, is described. "This phenomenon is characteristic of Barnegat Bay. Oyster larvae tend to congregate in greatest numbers just above this 'discontinuity layer.' Oyster larvae are shown to react to an abrupt change in salinity of the water. An increase produces heightened activity of the velum, whereas a sharp decrease in salinity is accompanied by a lowered activity of the larva. Oyster larvae are stimulated by a current passing over them, the velum is fully extended and the cilia beat actively, carrying the larva upward. In still water the larvae come to rest within a period of 1 to 20 minutes at summer temperatures, the majority lying on the bottom with the velum uppermost and the cilia beating feebly. The importance of these reactions of the larvae in determining their distribution and the place of their subsequent attachment close to the ancestral home is discussed."

This is followed by a report of A Study of Oyster Problems in Barnegat Bay by Perkins (pp. 25–47). It is pointed out that for the fifth consecutive year there was no commercial set of oysters in Barnegat Bay, and the presence of the Manasquan Canal is not considered to have increased the mortality of

oyster larvae; neither has the destruction of oyster larvae by the ctenophore *Mnemiopsis* sp. been sufficiently great to account for the failure of the larvae to reach the setting age. "It is suggested that this great mortality in recent years is due to an artificial selection of the unfit; a weakened stock has resulted from the practice of removing the finest oysters for market and leaving the poorest to reproduce. The first general spawning of the season took place on June 13, and the few survivors of the brood set 13 days later. Other general spawnings occurred on July 5 and 23. Throughout the season and until observations ceased on September 1 there were many spawnings of lesser magnitude. In all, 15 different broods were noted.

"Counts made of oyster larvae taken in cross-sectional water samples show that they are found in greatest numbers at a point usually midway between surface and bottom. This area of greatest concentration of larvae could not be correlated with fluctuations in temperature or pH as seen in the portion of Barnegat Bay under observation. Only occasionally did the larvae appear in greatest numbers at the surface of the halicline; hence the variations in vertical distribution are not to be accounted for on the basis of organic response to salinity changes. . . .

"A study of the tides yielded curves of vertical distribution of current velocities very similar to the various curves made from earlier observations of the distribution of oyster larvae. It is possible to correlate the levels of larval concentration with levels of greatest current velocities. It is believed that the larvae are distributed passively by the current in accordance with a well-known principle of hydrodynamics, and that their ciliary activity is sufficient only to raise them into the sweep of the current."

A glimpse into the life history of the tapeworm of sheep, Moniezia expansa, D. F. SINITSIN (*Jour. Parasitol., 17 (1931), No. 4, pp. 223–227, pl. 1, fig. 1*).—The author here gives an account of studies of the eggs of this tapeworm of sheep, of which nothing is known regarding its behavior. The studies have shown quite distinctly the way in which sheep become infested with this parasite. The observations begin with the moment when eggs, inclosed in the body of ripe segments, leave the intestine of the sheep with the excrements and end at the forty-fifth day of their being at large and outside of any host.

[Report of work in entomology and parasitology at the California Station] (*California Sta. Rpt. 1930, pp. 63–69, 104*).—In continuing work with the use of light as an attrahent to the codling moth (E. S. R., 62, p. 751), by W. B. Herms, A. D. Borden, and J. K. Ellsworth, the number of 500-watt lights in the orchard was increased by 20, the number of illuminated trees remaining 15. These lights were operated daily during the evening hours from April 24 to October 24, 1929, the fruit in the lighted orchard at harvest time showing approximately the same percentage of worminess as the fruit in the check areas.

Experiments in the production of all stages of the codling moth throughout the winter, carried out by G. S. Hensill from September to early April, resulted in the development of methods by which it is possible to secure any life stage of the insect at any time of the year. Overwintering larvae were exposed to low temperatures in cold-storage rooms and caused to pupate several months earlier than they would have pupated in the field. This method facilitates winter experiments with an insect found as a rule only during the summer. Moth emergence in Santa Clara Valley in 1930 up to July 1 showed the peak of the first brood to have occurred the fore part of May. The practical value of the bait trap as an indicator for timing spray applications was demonstrated by Borden during the season of 1929, one of the heaviest codling

moth years on record on the Pacific coast. Four sprays timed by the bait traps showed under 6 per cent of worms, while from 5 to 7 sprays applied as usual (i. e., without the use of bait traps) gave from 35 to 75 per cent of wormy fruit.

During the course of the life history studies of the willow weevil (*Stamoderes uniformis* Casey) in its relation to apples, Borden found a much larger area to be infested than was at first reported, the area from Sebastopol to the Russian River being badly infested.

Winter spraying with oil and lime sulfur, together with summer treatments of light oils and liberation of predators and internal parasites, is reported by Borden to have kept the infestation of the citrophilus mealybug (*Pseudococcus gahani* Green) on pears and apples in Santa Cruz and Monterey Counties under commercial control. In control work with the citrophilus mealybug in connection with ornamental and garden plants, E. O. Essig found repeated hosings with water followed by spraying with any of the highly refined summer oil emulsions to give good results. Parasites taken in Australia, obtained by H. Compere from H. S. Smith and liberated in Berkeley, appear to have been effective in cleaning up a serious infestation of the citrophilus mealybug on native and cultivated plants. Tests have shown the control of the Argentine ant to be an important factor in the control of this mealybug.

In research work by W. M. Hoskins on the toxic action of insecticides, particular attention was given to the passage of insecticides through membranes. An apparatus was set up for the electrometric determination of the pH of biological solutions.

Experimental work by H. H. P. Severin on the transmission of yellows disease of plants by the six-spotted leafhopper demonstrated that White Belgian and Short White carrots and Hamburg parsley were naturally infected with yellows disease. "The same varieties of economic plants grown from seeds were experimentally infected with the yellows disease in the greenhouse. After symptoms of yellows developed, noninfected six-spotted leafhoppers feeding on the experimentally infected plants became infective and transmitted the disease to healthy asters and celery. The disease was transmitted from infected asters and celery back to carrots and parsley. Yellows disease was also transmitted from infected carrots to healthy carrots and similarly from parsley to parsley, carrot to parsley, and parsley to carrot. These experiments prove that the virus of carrot, parsley, celery, and aster yellows are identical."

The Pacific coast mite (*Tetranychus pacificus* McG.) was found by J. F. Lamiman to commence to appear in great numbers as soon as the hot weather arrived, and the infestation of grapes to continue until after the middle of August. Late in the fall the mites were found hibernating beneath the bark below the surface of the soil. A very finely ground sulfur dust applied thoroughly to both surfaces of the leaves was found to be the most satisfactory control measure.

Reference is made to a further study by L. M. Smith of the life history and control of the mealy plum aphid in Placer, Yolo, and San Joaquin Counties. The best control resulted from applications of a highly refined oil, at 2 per cent, on March 16, 27, and April 4, 1930. This increased the clean trees from 22 to 93 per cent on May 12. Subsequent multiplication of the aphid greatly reduced this apparent control.

A field survey by L. M. Smith failed to show any correlation between the distribution of a recent severe outbreak of pear blight and any particular species of insects. In field cages blight was transmitted by the tarnished plant bug and one species of aphid, while many other species failed to transmit the disease.

A study was made by L. M. Smith of the bean thrips, which has been responsible in Napa County for severe injury to pears, the life cycle in cellophane cages on the trees having been completed during July within 29 days. In control work with sprays and dusts, best results were obtained with a 2 per cent light oil and 0.5 pint of Blackleaf 40 to 100 gal., and by fine dusting sulfur applied at about 15 to 20 lbs. per acre.

In a study by S. F. Bailey of the life history of the bean thrips (*Heliothrips fasciatus* Perg.), made in Monticello and Davis, it was found to pass the winter in the adult form, the last larvae being found in the field on November 9, 1929, and not again until May 9, 1930. There appears to be a definite succession of host plants of the bean thrips in Monticello. The winter is passed by the adults chiefly on filaree (*Erodium cicutarium*) in the orchards. When the weeds in the orchard are plowed under, the thrips migrate to the pear trees as well as other weeds along the roadside, particularly wild spiny lettuce (*Lactuca scariola*). As the pear leaves begin to drop the adults seek the remaining plants of filaree and spiny lettuce to tide them over until the rains bring up the weeds in the orchard again. In contrast with other species of thrips the bean thrips appear to require a high temperature and low humidity.

Reference is made to biological studies of the root knot nematode (*Caconema* (*Heterodera*) *radicicola*) under way by J. Tyler. It was found that while the larvae can live from 1 to 2 years in the soil, it is almost impossible to obtain infestations from potato material that is 6 months old.

In experimental control work with the corn ear worm, continued by F. H. Wymore, sodium fluosilicate (70 per cent active, 30 per cent inert) was found consistently better than other materials, one treatment at 70 per cent strength having proved fairly efficient in controlling the worms in a near-by plat. Black pepper again gave fair results, apparently as a moth repellent. Little or no benefit was derived from the third application of any of the materials used. Sodium fluosilicate, black pepper, and arsenate of lead (1 part to 4 parts of hydrated lime) produced the best effects when applied to the ear in the silk stage.

The work with the vegetable weevil, by O. H. Lovell, was continued in cooperation with the U. S. D. A. Bureau of Entomology. Oviposition commenced the middle of September and continued until the middle of January, the incubation period lasting from 18 to 20 days. The larval period continued from the first of October to December or January. They entered the soil to pupate, the pupal period lasting from 14 to 16 days. Sodium, barium, and calcium fluosilicates were used with success in combating the larvae. A 50 per cent miscible carbon disulfide was used on the ground against pupae but had no killing effect. Analyses made by the U. S. D. A. Bureau of Chemistry and Soils indicate that on vegetables which are washed before marketing, and especially those washed before bunching, there is not sufficient residue from various fluosilicates to be dangerous for human consumption even though dusted excessively.

Work on the pepper weevil was continued by A. C. Davis in cooperation with the U. S. D. A. Bureau of Entomology. The loss from pepper weevil damage in 1929 varied from 0 to 25 per cent in pepper-growing areas, averaging about 10 to 15 per cent. In the fall of 1929 the weevil was found to be attacking eggplant at Huntington Beach. Observations made during the winter and early spring showed that this pest is present in some numbers throughout the pepper-growing districts of San Diego, Orange, and Ventura Counties in places where pepper or Solanum plants were left standing. The plants now known to be capable of being used by the weevil for breeding are *S. douglasii*, *S. nigrum*,

S. xantii, and *S. esculentum* (eggplant). The weevil was reared successfully from *S. xantii* in the laboratory. In field experiments in 1929 calcium arsenate gave good control in most cases.

The diastase work carried on by G. H. Vansell and S. B. Freeborn was practically completed. "The recent findings that California honeys vary widely in diastase, directly in proportion to pollen grains, have apparently been accepted. In connection with these investigations the Fiehe test used to detect overheating has been shown unreliable. Nonheated, extracted honeys several months old, particularly where granulation occurred, gave a positive Fiehe reaction."

The respiratory exchange investigations by Vansell yielded additional data, particularly for the winter season. The amounts of carbon dioxide and water produced correlate in general with the consumption of honey. During time of confinement to the hive, the bees are evidently able to remove water from the air.

Experiments by P. F. Nichols, H. S. Reed, and I. J. Burger indicated that the injury to Calimyrna figs due to insect infestation and mold infection could be reduced by sulfuring and dehydrating.

[Report of work in entomology at the California Citrus Experiment Station] (*California Sta. Rpt. 1930, pp. 34–37, fig. 1*).—The results obtained in the use of emulsions, of which there were about 35 proprietary brands on the market in 1928 and upward of 50 brands sold for citrus spraying in 1930, show them to vary widely in regard to insect control and injury to trees. They also varied greatly in oil-depositing qualities, certain brands depositing several times as much as others.

The walnut husk fly is a new pest which has been found to represent the new subspecies *Rhagoletis suavis completa* Cress. Control work has shown basic lead arsenate, either sprayed or dusted on the trees, to be effective in keeping the pest under control. In laboratory tests fluorine and fluosilicate compounds, except that of calcium, killed the flies more quickly than the basic lead arsenate, while copper sulfate seemed to be of about the same toxicity as the lead arsenate. Control of the gray ant was obtained in the field through the use of double-strength Argentine ant poison. Where this was used in connection with repellent bands the infestation was greatly reduced within a few weeks.

The parasitism of the citrophilus mealybug (*Pseudococcus gahani* Green) by *Coccophagus gurneyi* Comp. and *Tetracnemus pretiosus* Timb. was maintained at a high rate through the winter when the mealybug population is normally low, and this had the result of reducing the pest to the point where no damage was done during the spring. As a result of the work with these new parasites (E. S. R., 62, p. 751), the citrophilus mealybug is less frequently found at present than it has ever been since it became a major pest of citrus trees. In a study made of the developmental curve of the citrophilus mealybug in San Diego County, it was found that the population is sparsest during the months of March and April, and that for best results in control by Cryptolaemus, liberations should be made in June and July.

Reference is made to an expedition to Eritrea in the fall of 1929 in search of parasites for the black scale (*Saissetia oleae*). Contrary to expectations it was found that the black scale is not kept down to harmless numbers in that country, it being extremely abundant in spite of work of the parasites. At Nefasit, however, it is uncommon, the scarcity being apparently due to a combination of parasites and unfavorable climatic conditions. Of the species discovered by Silvestri, only one, *Diversinervus elegans* Silv., seemed to be of probable economic importance if introduced into California. A discovery of importance was that of the finding of several parasites of what is apparently the citrus mealybug. The expedition resulted in the successful importation of a parasite of the

common mealybug, and the discovery of eight primary parasites of the black scale, all of which were lost in transit.

Particular attention was paid to the development of mass-production methods for possible use in the production of beneficial insects for orchard colonization. The common horseweed (*Erigeron canadensis*), which was tested as a host for black scale, appears to be of value for that purpose, the life cycle of the scale on this plant being about three months during the summer. A preliminary test of potato sprouts for the production of red scale for insectary use indicates that they may be satisfactory for this purpose. The egg parasite *Trichogramma minutum* is being tested as a control for the orange tortrix, a high percentage of parasitism having been obtained where liberations were made on two heavily infested orange trees.

[Report of work in entomology at the Michigan Station] (*Michigan Sta. Bien. Rpt. 1929–30, pp. 25–27*).—It is pointed out that the fruit tree leaf roller has increased in importance in Michigan until its ravages have placed it in the front rank as a major enemy of apples and pears. While it has not been successfully controlled by the use of arsenical sprays, it has been held under control to the extent of 98 per cent by use of homemade emulsions made from Diamond Paraffin oil, emulsified with Kayso, and used at a strength of 6 per cent. In the course of an experiment it was found possible to spray trees with an 8 per cent emulsion made in this way without injury to the trees, but a 6 per cent strength gave as high a kill of the eggs as the higher concentration.

A beetle new to Michigan, identified as *Trogoderma versicolor*, was discovered for the first time in the State working in dried sweet corn at East Lansing. This species is of foreign origin, and little is known of its history and food plants in this country.

[Contributions on economic insects] (*Proc. 4. Pacific Sci. Cong., Java, 1929, vol. 4, pp. 1–7, 133–142, 143–156, pls. 12; pp. 181–183, 209–222, 305–320, 379–384, 391–400, figs. 3; pp. 519–527, pl. 1, figs. 3; pp. 561–594*).—The contributions on economic entomology presented at the Fourth Pacific Science Congress, held in Java in 1929 (E. S. R., 61, p. 753), are as follows: Pests of the Rice Crop round the Pacific—I, The More Important Pests of the Rice Crop in the Dutch East Indies, by P. van der Goot (pp. 1–7); Brief Notes on Some Padi Insects in Malaya, by G. H. Corbett (pp. 133–135); Three Insect Pests and Their Parasites in Hawaii, by H. F. Willard (pp. 137, 138); On Some Injurious Insects of the Sugar-Cane in Formosa, by S. Matsumura (pp. 139–142); The Termite Problem in the Pacific Area, by T. E. Snyder (pp. 143–156); The More Important Insect Enemies of the Rice Crop in Chosen, by S. Nakayama (pp. 181–183); Important Insect Pests of the Rice Crop in Japan, by S. Kuwana (pp. 209–216; Coöperation in Parasite Work around the Pacific, by S. Leefmans (pp. 217–222); The Rice Stem-Borers in Japan (pp. 305–320) and Biological Notes on Two Egg-Parasites of the Rice Stem-Borers in Japan (pp. 379–384), both by I. Kuwana; Three Insect Parasites of Cultivated Plants [trans. title], by N. C. Tieu (pp. 391–400); Researches on the Hymenopterous Parasites of the "Borer" (*Xylotrechus quadripes* Chev.) [trans. title], by R. du Pasquier (pp. 519–527); Preliminary List of Parasites and Predators of Some Important Insect Pests in the Netherlands Indies, by S. Leefmans (pp. 561–568); A Summary of Insects Affecting Rice in the Philippines, by L. B. Uichanco (pp. 569–582); List of Insects with Their Parasites and Predators in Malaya, by G. H. Corbett (pp. 583–592); and Parasites of Pests of Field Crops, Vegetables, and Citrus, by D. T. Fullaway (pp. 593, 594).

Blueberry and huckleberry insects, C. R. PHIPPS (*Maine Sta. Bul. 356 (1930), pp. 107–232, pls. 40*).—Following a brief introduction, some of the factors influencing insect abundance in blueberry fields, including mixed stands

of blueberry and other plants, periodic burning, and proximity of food and shelter, are considered. Pollination studies, next taken up, show that various species of insects, especially honeybees, bumblebees, and other bees, carry blueberry pollen, and that such insects undoubtedly exert a marked influence on blueberry pollination, since their exclusion affects yields so strikingly. Life history studies of the Maine species of blueberry insects, with suggestions for control, which follow, are dealt with under the headings of Orthoptera, Hemiptera, Homoptera, Thysanoptera, Coleoptera, Diptera, Lepidoptera, and Hymenoptera, respectively. Among the insect enemies given particular attention are the spittle bug *Clastoptera proteus* Fitch (pp. 122, 123); a new thrips enemy, *Frankliniella vaccinii* Morg. (pp. 125–128); the blueberry flea beetle, *Altica torquata* Lec. (pp. 129, 130); the blueberry leaf beetle *Galerucella vaccinii* Fall. (pp. 130, 131); the blueberry maggot (pp. 132–136), an earlier account of which by Patch and Woods has been noted (E. S. R., 49, p. 657); the chain-spotted geometer (pp. 138–146); and many cutworms and owlet moths (pp. 150–178). A catalogue of insects injurious to blueberry and huckleberry, systematically arranged, which lists the hosts, injury, distribution, and references for the various forms implicated follows. A three-page list of references to the literature cited and an index to the various species are included. The work supplements that of Woods previously noted (E. S. R., 34, p. 851).

Insect and allied pests of plants grown under glass, E. I. McDaniel (*Michigan Sta. Spec. Bul. 214 (1931), pp. 117, figs. 72*).—This is a practical account of the insect and allied pests of the greenhouse and means for their control. A host index is included.

Control of red mite on apple by winter spraying, J. Carroll and T. Turpin (*[Irish Free State] Dept. Agr. Jour., 30 (1931), No. 1, pp. 121–127*).—Combination sprays made by mixing certain oils with tar distillates gave a better control of the red mite, *Oligonychus ulmi*, than the oil sprays alone, and at the same time were absolutely efficient in killing the eggs of aphid and apple sucker.

The northern fowl mite, Liponyssus sylviarum, of poultry, W. A. Maw (*Sci. Agr., 11 (1931), No. 10, p. 710*).—The author records the occurrence of this fowl mite at Macdonald College in the Province of Quebec, this being the third report of its occurrence in Canada.

The silverfish as a pest of the household, E. A. Back (*U. S. Dept. Agr., Farmers' Bul. 1665 (1931), pp. II+6, figs. 4*).—This is a revision of and supersedes Farmers' Bulletin 902, previously noted (E. S. R., 38, p. 364).

A general biological study of the lychee stink bug, Tessaratoma papillosa Drur. (Heteroptera, Pentatomidae), R. B. Falkenstein (*Lingnan Sci. Jour., 10 (1931), No. 1, pp. 29–82, pls. 2*).—An extended account of the biology and natural control of this enemy of litchi, based upon observations and experiments from 1924 to 1926, inclusive, principally in Canton, China.

The relation between insect and virus as shown in potato leaf roll, and a classification of viroses based on this relation, D. L. Elze (*Phytopathology, 21 (1931), No. 6, pp. 675–686*).—This is a discussion, contributed from the Netherlands, of the present-day knowledge of the significance of various insects in relation to the spread of the virus diseases of the potato. The green peach aphid, which is particularly well adapted for spreading such diseases, has been studied, especially in connection with leaf roll. Data presented in tabular form show that in the experiments in which the most favorable circumstances for infection were provided the green peach aphid infected all 22 plants used, *Aphis rhamni* 13, *A. fabae* 6, and *Psylliodes affinis* 8 plants. A list of 30 references to the literature is included.

The migration of butterflies, C. B. Williams (*Edinburgh: Oliver and Boyd, 1930, pp. XI+473, figs. 71*).—Part 1 of this work consists of a preliminary discussion (pp. 5–40), part 2 presents the evidence according to species (pp. 41–277), in part 3 migrations are considered geographically (pp. 279–312), part 4 is devoted to a general discussion (pp. 313–426), and part 5 contains a bibliography of 27 pages.

[The pink bollworm in the Virgin Islands], M. S. Baker (*Virgin Islands Sta. Rpt. 1930, pp. 14, 15*).—Pink bollworm larvae were found in the first blooms that opened, and about 15 per cent of the cotton bolls were infested. It is pointed out that the seed had been treated with sulfuric acid before planting. In an effort to check the ravages of the pink bollworm, one plat of five rows of sea island cotton was sprayed at regular intervals with Bordeaux mixture in which lead arsenate had been incorporated, this plat yielding 159.9 lbs. more of seed cotton per acre than did the untreated. Paradichlorobenzene in kerosene was poured about the roots of the cotton plants without injury, the odor being noticeable for 60 days after the application.

A seed caterpillar, Grapholitha conversana Wlsm., on a native clover in the North Pacific region, L. P. Rockwood and S. K. Zimmerman (*Jour. Agr. Research [U. S.], 43 (1931), No. 1, pp. 57–65, figs. 5*).—Observations of a lepidopteran found occasionally atacking the seed of a native clover, *Trifolium involucratum fimbriatum*, on the seacoast of Oregon are reported upon. This insect is of importance since it has already been found occasionally on red clover and may become adapted to cultivated clovers, which in the Pacific Northwest have hitherto been free from any clover pest comparable to the clover seed caterpillar of the Eastern States (*Enarmonia*) *G. interstinctana* Clem.). In its attack on the native host the ovules and young seed pods are consumed with considerable loss in seed production. Two braconid parasites, namely, *Orgilus mellipes* (Say) and *Microbracon hyslopi* Vier., have been reared from this insect.

Experimental research on generations and biological phenomena in Anopheles maculipennis [trans. title], E. Roubaud (*Riv. Malariol., 10 (1931), No. 1, pp. 1–42, pl. 1, figs. 11; Ital., Fr., Eng., Ger. abs., pp. 154, 155, 156, 157, 159*).—A report of the results obtained in rearing the malarial mosquito, of which three to four successive annual generation cycles were obtained.

An ecological study of the tobacco beetle, Lasioderma serricorne Fabr., with special reference to its life history and control, T. E. Powell, Jr. (*Ecol. Monog., 1 (1931), No. 3, pp. 333–393, figs. 20*).—Following a brief introduction and historical discussion, experimental methods are considered, followed by a report of experiments conducted.

A complete treatise on apiculture, E. Alphandéry (*Traité Complet d'Apiculture. Paris: Berger-Levrault, 1931, pp. VI+572, pls. 10, figs. 900*).—Parts 1 to 12 of this work deal, respectively, with the history of apiculture (pp. 1–21), the bees (pp. 23–96), the hive (pp. 97–156), operations of the apiary (pp. 157–236), diseases and enemies of bees (pp. 237–264), bee flora (pp. 265–321), honey (pp. 323–365), wax (pp. 367–435), bee literature (pp. 437–478), legislation (pp. 479–492), apiculture in France (pp. 493–502), and apiculture throughout the world (pp. 503–545). The thirteenth part consists of a bibliography of French works on apiculture (pp. 549–560) and the principal works in English (pp. 560, 561).

Eupteromalus nidulans, a parasite of the brown-tail and satin moths, A. B. Proper (*Jour. Agr. Research [U. S.], 43 (1931), No. 1, pp. 37–56, figs. 5*).—This is a report of studies of the biology and habits of *E. nidulans* (Thomson), a rather small external parasite introduced into Massachusetts from Europe in 1905 as an aid in the control of the brown-tail moth. The author concludes

that this pteromalid, which, since its introduction, has been reared both as a primary and as a secondary parasite, is of slight importance as an enemy of the brown-tail moth, although it shows some promise as a parasite of the satin moth.

The species hibernates as a mature larva within the web or cocoon of its host. There may be as many as two generations each year upon primary parasites in the spring, and as many as three generations, the third hibernating in the fifth larval instar, upon the satin moth in the fall. However, there may be no reproduction upon primary parasites, and but one or two generations on the satin moth in the fall. The eggs are deposited upon the surface of the host, no definite part of the body being preferred for the location of the egg. Superparasitism is common, and hosts are frequently paralyzed but no eggs are laid. The paralysis of the hibernating larvae of the satin moth is permanent.

Although the percentage of parasitism of the satin moth over the entire area has not had a constant or marked increase during the years in which this parasitism has been studied, there undoubtedly was an increase between 1926 and 1929. It seems reasonable to expect that the parasite will follow the host as the latter spreads to its climatic limits, and that as the parasite catches up with the host the average percentage of parasitism will increase. Consequently, if the present rate of increase continues, the percentage of parasitism of the hibernating stage of this moth by Eupteromalus will become of greater economic importance.

Anaphoidea calendrae Gahan, a mymarid parasite of eggs of weevils of the genus Calendra, A. F. SATTERTHWAIT (*Jour. N. Y. Ent. Soc., 39 (1931), No. 2, pp. 171–190, fig. 1*).—This is an account of the corn billbug egg parasite, *A. calendrae*, a monembryonic, gregarious hymenopteran which parasitizes eggs of several species of Calendra, especially *C. minima*, *C. parvula*, and *C. callosa*, all of which hosts are very destructive to corn, small grains, and grasses. It is pointed out that the usual number of parasites developing in one host egg is seven, with one male and six females. The species has been known to destroy 75 per cent of the billbug eggs, in which host plant it has been most intensively studied. In the latitude of St. Louis the author has found at least four annual generations, with sometimes probably seven. The larvae remain inactive from July, August, or September, pupating in the following spring.

ANIMAL PRODUCTION

Predicting gains in feeder cattle and pigs, J. L. LUSH (*Jour. Agr. Research [U. S.], 42 (1931), No. 12, pp. 853–881*).—The animals used in this study at the Texas Experiment Station were steers that had been fattened during 3 years at the Spur Substation and 2 years at College Station and pigs from 3 feeding tests in different years at College Station. After the animals were divided into lots, each of several men trained in animal husbandry rated each animal according to the amount of gain he believed that animal would make relative to the average of its lot (one test for steers) or relative to the animal he believed would make the best gain in the lot. In 3 of the steer tests an estimate was also made of what each animal would be worth per pound of live weight at the end of the feeding period. Correlation coefficients were calculated by the usual product-moment method for each lot of animals separately, observed gain, initial weight, and each estimate of gain being used as the variables. All possible correlations between these variables were calculated.

The differences in initial weight were only slightly correlated with differences in gain in the case of steers, but were distinctly correlated with gain in the case of pigs. The average correlation was +0.24 based on the statistical

equivalent of one lot of 224 steers and +0.52 based on one lot of 128 pigs. The average correlations between estimates and gains in the pig experiments were +0.05, +0.63, and +0.64, and for the steer experiments −0.03, +0.33, +0.33, +0.04, and +0.24. The correlations were large enough to be significant and to demonstrate the desirability of balancing lots as carefully as possible at the beginning of experiments.

The proportion (squared multiple correlation) of the causes of gain which were associated either with differences in initial weight or with things seen by the man who made the most successful estimate in a particular test ranged from 3.9 to 16.2 per cent for gains in the steer tests, from 10.6 to 46.9 per cent for gains in the pig tests, and from 22.3 to 31.9 per cent for final values in the steer tests. The estimates were closely correlated with initial weight, especially in the pig tests, but there were several cases of negative partial correlation coefficients between estimate and gain, initial weight being constant. Where the final value was estimated, these estimates were somewhat more successful than the estimates of gain.

The outstanding findings of this experiment were the large amount of variation in gain and final value that was not foreseen by the trained men. The results indicate that possibly the factors which determine rate of gain and final value of animals are not closely associated with visible differences.

The digestibility of cottonseed meal as a supplemental feed for range cattle in New Mexico.—II, With low protein intake, W. E. WATKINS (*New Mexico Sta. Bul. 194 (1931), pp. 50, figs. 4*).—Continuing this study (E. S. R., 62, p. 760), an effort was made to determine nitrogen balances of steers while under different maintenance and submaintenance conditions. The steers were fed individually throughout the 7 trials. In order to get the steers into a losing condition for the first 2 periods of 28 days each, the steers received only a ration of wheat straw ad libitum. After 18 days of each period they were put into digestion stalls for a 10-day digestion trial. Beginning with the third period the steers received 0.25, 0.5, 0.75, 1, and 1.5 lbs. of cottonseed meal in the respective periods in addition to the wheat straw.

The addition of a small amount of cottonseed meal caused an increase in the consumption of roughage. The steers made an average daily gain of 0.6 lb. per head during the course of the study. A large fill of straw made the gains during the first period abnormally large, but when the gains for the last 6 periods were averaged it was found that the steers made an average daily gain of 0.52 lb. per head.

Nitrogen balances were negative during the first 3 periods and positive during the remaining periods. With a positive nitrogen balance much larger gains in live weight were obtained than when the nitrogen balances were negative. The added proteins were almost solely responsible for the increase in total digestible nutrients in the ration, which indicated that protein was probably the most important nutrient among the total digestible nutrients. The digestibility of crude fiber remained practically constant throughout the test. The presence of metabolic products in the ether extract of the feces made it impossible to determine accurately the digestibility of the ether extract.

As the amounts of total digestible nutrients in the ration were increased, the pulse rate of the steers increased, indicating that pulse rates are rather accurate indexes of metabolic intensities of animals. Body measurements showed that the growth of the steers was retarded during the greater part of these trials. Because of the low plane of nutrition the coefficients of digestibility were from 2 to 20 per cent lower than when regular rations were fed. During periods 4 to 7, inclusive, the steers retained 15.9, 28.8, 42.1, and 25.5 gm. of body protein per pound of cottonseed meal consumed.

These results explain how a small amount of protein-rich supplement might prevent losses during emergencies, as 0.5 lb. of cottonseed meal was quite efficient for starting animals to gain in body protein and in live weight.

Beef producing qualities of purebred Aberdeen-Angus cattle compared with Arkansas native cattle, H. E. DVORACHEK and A. T. SEMPLE (*Arkansas Sta. Bul. 247 (1931), pp. 19, figs. 9*).—This is another account of work previously reported in U. S. D. A. Technical Bulletin 203 (E. S. R., 64, p. 463).

[Sheep studies in California] (*California Sta. Rpt. 1930, p. 56*).—In a study with 4 lots of 25 lambs each, it was found that fish meal was a satisfactory protein supplement for fattening lambs and that the animals relished this feed. Adding potassium iodide to the salt of the ration increased the rate of gain somewhat as compared with the check lot. Satisfactory mutton was produced in all lots, and there was no taint or ill effect due to the ration found in any carcass.

Over a period of 10 weeks, 6 ewes with twin lambs produced about 30 per cent more milk than 6 ewes with single lambs.

[Experiments with sheep in Nevada], C. E. FLEMING ET AL. (*Nevada Sta. Rpt. 1930, pp. 13–15*).—*Continuing studies previously noted* (E. S. R., 62, p. 62; 63, p. 557), several experiments are reported.

Pasture carrying-capacity tests.—Over a 5-months grazing season rotated pastures had from 40 to 50 per cent greater carrying capacity than a pasture continuously grazed. Approximately the same increase in mutton growth was obtained on the two pastures, but on the rotated pastures a larger number of lambs were grazed for a longer period than on the continuous pasture. The daily gains of the lambs were much greater than those of mature sheep, which accounts for the greater number of pounds of lamb growth on the rotated pastures.

Rate of growth in lambs.—Feeding tests by Fleming and A. Young showed that single lambs made 69 per cent of their season's growth in 17 weeks and twin lambs 64 per cent, and that at 34 weeks the single lambs had made 84 per cent and the twins 86 per cent of their season's growth. At the end of a year twin lambs weighed as much as two single lambs.

Approximately one-half of the first year's growth of lambs was made in the first 90 days, and at the age of 4 months on pasture lambs had made their most economical gains.

In comparison with a ewe, how much does a lamb eat?—In an effort to determine the grass consumption of lambs as compared with mature sheep, lawn clippings were fed to sheep and lambs in dry lot from early spring to late fall. It was found that dry ewes ate about 12 lbs. of clippings daily, a ewe and lamb more than 23 lbs., and a ewe and twin lambs about 34.5 lbs.

Concentrates in rations for range ewes, W. E. JOSEPH (*Montana Sta. Bul. 247 (1931), pp. 11, figs. 2*).—Concluding this series of 7 tests (E. S. R., 60, p. 761), an attempt was made to determine the comparative value of different concentrates as substitutes for part of the hay in a winter ration. It was found that corn was about 7 per cent more valuable than oats, and cottonseed cake about 3.5 per cent more valuable than corn pound for pound. It was also shown that a pound of cake or corn was equivalent to not more than 3 lbs. of alfalfa hay, when the cake or corn was fed at the rate of from 4 to 5 oz. per head daily and the alfalfa hay graded No. 2 or better. Based on the results of these trials, corn probably gave the most accurate average equivalent value, namely, 2.54 lbs. of alfalfa hay per pound of corn. The gains made by the ewes in these tests were not sufficient to account for the weight of the fetus and fetal fluids and membranes.

At the prices usually prevailing the rations ranked in the following order of economy: (1) Alfalfa hay, (2) alfalfa hay and oats, (3) alfalfa hay and corn, and (4) alfalfa hay and cottonseed cake. The waste incurred in feeding the rations on the ground might modify the results somewhat, but the order would not be changed.

There was no evidence in these trials to indicate that the difference in the weights of fleeces could be attributed to differences in the feeding values of the rations. There were no significant differences in the weight or strength of single lambs or of twin lambs born in the lots receiving the various rations. However, the single lambs were somewhat stronger at birth than twin lambs.

The comparative prices of alfalfa hay and corn and the equivalent values of corn, cake, and oats based on no waste of concentrate are given in tabular form.

Studies with Hampshire sheep, No. 1, F. S. Hultz and M. A. Alexander (*Wyoming Sta. Bul. 178 (1931), pp. 30, pls. 4, figs. 3*).—In an effort to determine what constitutes a typical Hampshire carcass and fleece and which points receive the greatest emphasis in show ring selection of Hampshires, measurements, photographs, and wool samples were taken from all lambs and yearlings winning premiums in the individual classes at the 1930 International Livestock Exposition.

The study shows a noticeable correlation between the placings and the body measurements, especially in the ram classes. The ratios between the various body measurements were not so closely related to placing as were direct measurements. Since the ratios take into account symmetry, but tend to depreciate scale, it was considered possible that scale played a large part in the judge's selections. A set of values prepared for the measurements and their ratios indicated that a sheep that is average in most of the measurements, but excellent in some, is apt to receive a high placing in the show ring. The measurements and ratios dealing with the rear quarters appeared to be more closely related to the class ratings than any of the other measurements.

The photographs illustrated differences in style, scale, width, sex characters, and proportions in general.

A study of the wool samples showed that in general the more fine and dense fleeces occurred on the sheep placing highest in the show ring. The finest sample measured had a diameter of 0.000884 in., while the coarsest measured 0.00127 in. The densest fleece had 13,352 fibers per square inch and the least dense 4,040. The greatest number of crimps was 11.38 per inch, while the least number was 6.62. No undesirable skin color was found among the sheep studied.

[Experiments with swine in California] (*California Sta. Rpt. 1930, p. 57*).—In a long-time breeding experiment with hogs, the progeny resulting from three generations of the mating of litter mates showed some indications of increased difficulty in getting sows with pigs and of increasing uniformity of birth weights and color markings within a litter. The size of the litter remained unchanged, as did the health and vigor of the stock.

Chopped alfalfa fed with barley in amounts varying from 15 to 30 per cent of the ration was found satisfactory for growth and reproduction of swine. There were also indications that alfalfa hay could be used in larger amounts than usually recommended for growing pigs and for the breeding herd.

[Swine studies in Michigan] (*Michigan Sta. Bien. Rpt. 1929–30, pp. 7, 8*).—The results of three studies are noted.

A comparison of the portable cot and the central house for swine.—An average of 3 years' results (E. S. R., 61, p. 460) showed that pigs housed and fed in a central hog house made an average daily gain of 1.24 lbs. per head

and required 416.2 lbs. of feed, costing $7.07 per 100 lbs. of gain. Pigs housed in portable cots and fed in the open gained at the rate of 1.3 lbs. per head daily and required 397.6 lbs. of feed, costing $6.77 per 100 lbs. of gain.

A comparison of commercial mixed protein supplements with tankage when fed to pigs with farm grains.—The feed cost per 100 lbs. of gain of pigs receiving 60 per cent tankage was $6.40, for those receiving Purina Hog Chow containing 30 per cent protein $8.84, and for those receiving Wayne 28 per cent Hog Meal $7.81. In addition to the protein supplements, all pigs received shelled corn and ground oats self-fed. In a second test with a basal ration of shelled corn, alfalfa meal, and a simple mineral mixture self-fed free-choice, pigs receiving tankage cost $7.16 per 100 lbs. of gain, those receiving Wayne Hog Meal $8.85, and those receiving equal parts of tankage and Manamar $8.87.

The addition of tankage to the ration of pigs on pasture and being fed corn, barley, corn and oats, or barley and oats free choice.—Adding tankage to a ration of shelled corn for pigs on rape pasture increased the rate and decreased the feed required per unit of gain. Pigs fed barley alone gained faster and more economically than pigs fed shelled corn alone. Ground barley alone produced more rapid and economical gains than a ration of ground barley and ground oats. Adding ground oats to a shelled corn ration increased the rate of gain and lowered the feed requirements per unit of gain. The addition of tankage to a ration of either shelled corn and ground oats or ground barley and ground oats increased the rate and efficiency of gains.

Hog feeding experiments (*Nevada Sta. Rpt. 1930, p. 23*).—In this test the most economical method of producing pigs consisted of furnishing unlimited alfalfa hay and pasture with 2 per cent of barley until the pigs reached a weight of 140 lbs., after which barley was self-fed to 200 lbs. It was also found that with an abundance of milk and alfalfa hay, tankage did not improve the ration enough to justify its expense.

Soybeans as a protein supplement to corn for fattening pigs on forage, A. E. Tomhave (*Delaware Sta. Bul. 170 (1931), pp. 23*).—Concluding this series of studies (E. S. R., 64, p. 660), it was found that soybeans offer considerable possibilities as a home-grown protein supplement for pigs on rape and alfalfa forage. Soybeans were found to produce the most efficient results when fed in conjunction with tankage. As a protein supplement to shelled corn, soybeans produced slightly better results on alfalfa forage than on rape forage. Cracked soybeans produced slightly better results than ground soybeans when fed to pigs on rape pasture. Raw soybeans were not readily eaten by the pigs.

Although the consumption of soybeans was small in all lots, the average gains and feed requirements per unit of gain were satisfactory. The mixture of soybeans and tankage was more efficient than soybeans alone as a protein supplement to corn for pigs on rape or alfalfa forage. For pigs on rape pasture it was not found necessary to grind cracked soybeans for best results. Ground and cracked soybeans were practically equal in value to tankage when fed to pigs on either rape or alfalfa pasture.

[Poultry studies in California] (*California Sta. Rpt. 1930, pp. 88–91*).—Continuing the study of egg quality (E. S. R., 62, p. 764), no significant or characteristic seasonal variation was found for either individual hens or for averages of the group. Withholding green feed either fresh or dry, substituting meat scrap for fish scrap, or adding wet mash to the ration had no effect on egg quality over a 9-months period. The chemical composition of thick and thin egg whites was practically identical. For eggs up to 40 days of age the refractive index, total solids, and nitrogen content were the same for the two types of whites when taken from the same egg.

Eggs stored in a low concentration of carbon dioxide were preserved for long periods. The deterioration of eggs was arrested by carbon dioxide, but the fresh condition was not restored. The results indicate that the loss of carbon dioxide from the white is one of the prime factors in thick white deterioration.

A total of 42 experimental lots of incubating eggs, averaging 115 eggs per lot, were chilled in two series of studies. In the first series no significant difference in hatchability was observed, but in the second series the chilled lots were slightly but significantly lower in hatchability than the check lot, which received uninterrupted incubation.

The curve of embryonic mortality in White Leghorns showed a peak centering on the eighth-day stage of incubation, which agrees closely with the time of transition from carbohydrate to protein combustion as a source of energy.

In cooperation with the department of anatomy, a study was made of sardine meal as the sole source of protein as well as in conjunction with wheat and barley proteins for growing rats. The sardine meal was fed at levels approximating 100, 80, 60, 40, 20, 15, and 10 per cent, while yeast was used to supply vitamins B and G, fish oil to supply vitamins A and D, and 1 per cent each of sodium chloride and calcium carbonate was added when fish meal was fed at 20 per cent or lower levels. The best growth was obtained on a mixture of sardine meal 20, wheat 80, yeast 2, sodium chloride 1, and calcium carbonate 1. No mixture of natural foodstuffs was found which would produce markedly better growth than the above mixture, and attempts to improve the ration with supplements produced little if any change in rate of growth. There was no significant difference between fish meal made from whole sardines and that containing a large proportion of entrails. A diet of wheat and gluten with a protein level approximating the best fish meal ration gave markedly inferior results.

The rate of growth of baby chicks increased as the protein level of the ration was increased from 10 to 20 per cent. Beyond 20 per cent the increase in rate of growth continued, but was accompanied by such complications as crooked legs and slipped tendons. The higher the protein level, the earlier these symptoms appeared. Protein levels of 15, 20, and 24 per cent for the first 16 weeks failed to affect the age of sexual maturity.

In cooperation with the division of agricultural engineering, it was found that sufficient ventilation to prevent condensation of moisture on the floor and other cooler parts of the hover was ample for the health and growth of chicks to 6 weeks of age. Controlled ventilation of poultry houses was more effective than insulation in regulating temperature in unheated poultry houses.

Observations indicated that direct sunlight was both effective and economical for improving production and hatchability. Under California conditions birds exposed to direct sunlight out of doors required no other source of vitamin D.

Turkey poults were found to require more protein than baby chicks, but when the amount of protein was raised too high irregular development resulted.

In a turkey breeding study to develop high fecundity, a Bronze turkey hen laid 170 eggs and 9 pullet daughters of this hen averaged 86.9 eggs, while 11 selected pullets from other hens laid an average of only 62.9 eggs.

Influence of thallium salts upon the molting mechanism of fowls, W. Landauer (*Jour. Agr. Research [U. S.], 43 (1931), No. 1, pp. 67–72, figs. 5*).—In this study at the Connecticut Storrs Experiment Station, young chicks and mature pullets and cockerels were treated with thallium salts to determine what effect the salts had upon molting.

It was found that the administration of thallium acetate to mature cockerels and pullets was followed by a diffuse loss of feathers. Most of the feathers lost came from the region of the throat, breast, neck, and head, and new feathers

were grown almost at once to replace those lost. The diffuse molting of pullets gradually became less pronounced, and the thallium ceased to have an effect upon plumage. With the cockerels large bare areas appeared on the lower part of the throat and upper part of the breast, sometimes extending to the neck. Regeneration of the feathers in these regions took place after a time, and simultaneously the thallium lost its effect on the feathers. The regenerated feathers were normal with regard to color, pattern, and shape, but it was observed in some cases that such feathers stayed in their sheath for an abnormally long time. The chicks were found to be more resistant to thallium poisoning than older birds, but their plumage showed no effect from the administration of the salts.

Of the different thallium salts used (acetate, fluoride, sulfate, carbonate), the acetate had the most pronounced and carbonate the least pronounced effect on the plumage.

Keeping the farm flock healthy, H. H. Alp (*Illinois Sta. Circ. 374 (1931), pp. 16, figs. 19*).—In this publication the principles and practices of sanitation by which poultry flocks may be kept in a healthy condition are described.

DAIRY FARMING—DAIRYING

[Experiments with dairy cattle in California] (*California Sta. Rpt. 1930, p. 57*).—Dairy calves were successfully grown to 18 months of age on concentrates and milk supplemented with cod-liver oil and alfalfa ash, while check animals not receiving the supplements failed to make normal growth.

[Experiments with dairy cattle in Michigan] (*Michigan Sta. Bien. Rpt. 1929–30, pp. 18, 19, 20–23*).—The results of several studies are noted.

The relative values of sources of lime for mineral supplements.—A study of such salts of lime as calcium chloride, calcium lactate, and calcium phosphate (in the form of bone meal) as mineral supplements for dairy cattle showed that the calcium chloride was the least valuable source of lime. This salt supplied the smallest amount of lime and caused a heavy loss of phosphorus from the body. Over 50 per cent of the calcium from calcium lactate was retained by the body, and in addition it increased phosphorus retention. Bone meal held an intermediate position between these salts, but its value was improved by the addition of milk sugar.

Bulk an unimportant factor to consider in the make-up of a grain ration.—Grain rations of varying bulk were fed to about 30 cows for a certain number of hours before they were killed. The rumens of the slaughtered animals were examined for lumps of unmixed feed. It was found that all the rations including linseed meal, the most cohesive feed commonly used, were mixed into the rumen contents so that the digestive juices could have full action.

Good hay carries factor or factors found in cod-liver oil.—Calves fed concentrates alone died of convulsions, but when hay was included in the diet they did not show these symptoms. Adding cod-liver oil to a ration of skim milk, yellow corn, and oats without hay permitted calves to grow normally to 28 months of age. Cows fed on concentrates alone produced dead or blind calves, but one cow fed cod-liver oil and no hay produced a normal calf.

Alfalfa leaves as a substitute for purchased protein.—To determine the value of alfalfa leaves as a protein supplement, 2 lots of 5 cows each were fed through 4 30-day periods, during which time their rations were alternated. One ration consisted of a complex grain mixture, corn silage, and alfalfa hay, while the other ration was a mixture of alfalfa leaf meal, ground oats, and ground rolled oats with silage and hay. There was no difference in the milk

production in favor of either ration, and metabolism tests showed that the cows on the alfalfa leaves utilized the nitrogen as well as those on normal rations.

The relative value of bone meal and raw rock phosphate as sources of calcium and phosphorus when used as mineral supplements to the ration of dairy cattle.—Both steamed bone meal and raw rock phosphate were found to supply all the calcium and phosphorus needed by dairy cows in addition to the amount present in the ration, but the raw rock phosphate was found to be injurious to the general health, lactation, and reproduction of the animals. The injurious effect of the raw rock phosphate was attributed to its high fluorine content.

The effect of fluorine feeding on the health and osteoid tissue of dairy cattle.—Feeding fluorine for short periods at levels of 0.03 per cent or more of the dry matter in the ration of 10 mature cows was sufficient to throw the animals off feed. When fed over a period of a year at a level equal to that which they would have received from a 3 per cent raw rock phosphate supplement, the teeth and long bones of the animals showed abnormal development.

Raising dairy calves on a minimum amount of milk.—In this study there were indications that calves can be raised successfully on not more than from 180 to 280 lbs. of whole milk.

Effect of feeding raw crushed cottonseed high in gossypol to dairy heifers.—A group of 3 growing heifers was fed a ration of ground corn, corn silage, timothy hay, and raw crushed cottonseed containing about 0.8 per cent of free gossypol for over 6 months without any poisonous effects.

Effect of a low phosphorus ration on dairy heifers.—A group of heifers receiving a ration low in phosphorus did not make as good growth as a similar lot to which bone meal was fed as an added source of phosphorus. The blood phosphorus of the lot on the low-phosphorus ration was lower than that of the other lot, especially after the animals came in milk.

Grain mixtures supplementary to Wyoming native hay for milk production, H. S. Willard (*Wyoming Sta. Bul. 182 (1931), pp. 23, fig. 1*).—The results of two experimental trials dealing with feeding grain as a supplement to Wyoming native hay are presented in this bulletin.

Continuing the first part of this study (E. S. R., 65, p. 171), 3 separate trials were conducted. In the first trial 2 groups of 3 cows each were fed by the reversal method for 30-day periods on a ration of straight wheat bran or a mixture of wheat bran and cottonseed meal 80:20. Native hay and sunflower silage were fed as roughages. The second trial was similar to the above except that 2 lots of 2 cows each were fed by the double reversal method through 3 periods of 30 days each. In the third trial 2 lots of 4 cows each were fed for 90 days on native hay. In addition one lot received a mixture of equal parts of barley and wheat bran and the other lot a mixture of barley, bran, and cottonseed meal 3 : 2 : 1. One cow in lot 1 of this trial had to be dropped before the end of the test.

In the first two trials little difference was noted in the total milk yields or in the rate of decline of milk yields. In the third trial the total milk yields on the two rations were practically identical, but the cows receiving cottonseed meal tended to hold up their production somewhat better than the other lot.

In part 2 of this study, 2 cows were fed for 90 days. At the beginning of the trial the cows were fed grain at the rate of about 1 lb. to 2.5 lbs. of milk. The experimental periods were of 10 days' duration, with a 5-day preliminary period during which the grain allowance was raised or lowered. A composite sample of milk was taken from each cow during the 10-day period.

The results of this study indicated that the addition of grain to the ration of cows late in lactation that had dropped in milk yield due to scarcity of feed was of doubtful economic value. These data also indicate why grain feeding seldom shows a profit when the reversal method is followed.

Can low priced wheat be fed to dairy cows at a profit? E. E. Jacobs (*[Oklahoma] Panhandle Sta., Panhandle Bul. 29 (1931), pp. 16–20*).—In this test 2 lots of 4 Holstein cows each were fed during 2 alternate 15-day periods on a ration composed of either 300 lbs. of milo, 100 lbs. of wheat bran, and 100 lbs. of cottonseed meal, or 200 lbs. of wheat, 100 lbs. of milo, and 75 lbs. of cottonseed meal. Lot 1 was started on the ration containing no wheat, while lot 2 was started on the ration containing wheat, and at the end of 15 days the rations were reversed. The cows were on native pasture during the test.

While on the ration containing no wheat, lot 1 produced an average of 159.5 lbs. of milk per day and lot 2 an average of 130.9 lbs. On the ration containing wheat, the average daily production was 161.38 and 137.9 lbs. of milk in the respective lots. When the ration containing no wheat was fed, lot 1 produced 2.61 lbs. of milk and lot 2 2.04 lbs. per pound of feed consumed, while the production for the ration containing wheat was 2.64 and 2.15 lbs. per pound of feed, respectively. The cost per pound of milk was 3.1 and 4 cts. in lots 1 and 2, respectively, while receiving the no-wheat ration and 3 and 3.7 cts. while receiving the ration containing wheat.

Based on the above results, it is concluded that at least two-thirds of the grain ration could be composed of wheat without causing a decline in milk production, that wheat was equal to milo for dairy cows, and that wheat did not need supplementing with bran and required less cottonseed meal. The relative economy of wheat depended upon its price and not upon its feeding value.

A test of the economic efficiency of alfalfa hay as a sole ration for dairy cattle and its relation to sterility, F. B. Headley (*Nevada Sta. Rpt. 1930, pp. 21–23, fig. 1*).—Continuing this study (E. S. R., 64, p. 169), the cows have shown no measurable ill effects from the great excess of protein in the exclusive alfalfa hay ration. Cows fed hay and grain produced more butterfat than those on hay alone, but the milk flow of the latter cows was consistently maintained. The cows receiving grain increased in weight with each successive year, while those on hay alone slowly lost weight. There were slight indications that the cows on the all-hay ration were more inclined to be sterile.

The calcium requirements of dairy heifers, J. B. Lindsey, J. G. Archibald, and P. R. Nelson (*Jour. Agr. Research [U. S.], 42 (1931), No. 12, pp. 883–896, figs. 6*).—Concluding this study (E. S. R., 65, p. 370) at the Massachusetts Experiment Station, it was found that the heifers in the high-calcium lot averaged 53.6 per cent greater storage of calcium per unit of weight than those in the low-calcium lot. On the basis of calcium intake, however, the high-calcium lot retained only 17.8 per cent as compared with 21.6 per cent for the low-calcium lot.

In 72 of the 76 trials the phosphorus balance was positive. On the average the high-calcium lot stored 45.5 per cent more phosphorus per unit of weight than the low-calcium lot. On the basis of phosphorus intake the high-calcium lot retained 27.4 per cent, while the low-calcium lot retained only 14.8 per cent.

The magnesium balances were negative in 48 of the trials, being equally divided between the two lots. The individual negative balances were somewhat larger in the low-calcium lot than in the high-calcium lot, giving the latter lot

a slight positive balance and the former lot a slight negative balance for the lots as a whole.

The intake of all elements per unit of weight decreased with increased age, and the retention per unit of weight almost always decreased in a similar manner. There was a considerable accumulation of a reserve of all elements by the high-calcium lot during the first year of life. However, the lower mineral storage by the low-calcium lot apparently had no ill effects upon the animals.

[Experiments in dairying in California] (*California Sta. Rpt. 1930, pp. 60–63*).—Continuing studies of the lactose and chloride content of milk (E. S. R., 62, p. 768), C. L. Roadhouse and J. L. Henderson found that variations in the interval between milkings produced no significant change in the concentration of these constituents.

Green foxtail, green wild oats, green alfileria, and green barley were fed at the rate of 20 lbs. to cows 2 hours before milking in tests by Roadhouse and Henderson. All the feeds produced a distinct feed odor and flavor in the milk, with foxtail being the least and alfileria the most objectionable.

No feed taste was present in the milk of cows fed either alfalfa hay or oat hay 5 hours before milking started. Cows consuming a mixture of alfalfa hay and green alfalfa more than 5 hours before milking produced milk with a flavor equal to that produced by cows fed good quality chopped oat hay.

Analyses by C. S. Mudge and G. A. Richardson of milk produced by cows on rations containing different relative concentrations of calcium and phosphorus failed to show that the altered mineral content of the ration had any influence either on the taste of the milk or on its lactose and chloride content.

Studies by Mudge and M. L. Thorwaldson have revealed the presence of characteristic thermophilic bacteria in many milk supplies. The organism was found in pasteurizing equipment either as a spore or in an unrecognizable form. The organism found in raw milk differed in its spore-forming tendencies from that present in pasteurized milk.

Mudge and L. O. Tucker found that the microflora of cold-packed strawberries increased when held at temperatures above 32° F., even when the sugar concentration was high, but that below this temperature there was a tendency for bacteria to decrease during storage. Such strawberries had no marked effect on the flavor of ice cream if the storage period was not unduly prolonged, if the berries were packed in a fairly high concentration of sugar, and if held at temperatures of 15° or lower.

In a study of the sticky, crumbly texture of butter produced in some sections during the winter months, Richardson and F. H. Abbott found that the feeding of a ration restricted to dry alfalfa hay was at least one of the causes of this trouble. Adding corn silage to the ration remedied this condition. A study of 47 samples of butter obtained from 4 cows fed dry alfalfa hay alone showed that the temperature of cream storage, of churning, of wash water, and of butter storage influenced the body and texture score of the butter.

A study by W. C. Cole and H. K. Wilson showed that vanillin, resins, ethyl alcohol, and anisyl alcohol all contributed to the characteristic vanilla flavor. Cole, Mudge, and Wilson also found that certain of the constituents of vanilla not only undergo chemical change but under favorable conditions are decomposed by certain bacteria present in milk and cream. In either case the resulting product has a less pronounced vanilla flavor than the original.

The relation of temperature to the distribution of certain of the constituents of ice cream between its liquid and solid phases was studied by Cole. Rapid freezing was found to produce smaller ice crystals than slow freezing.

The study indicated that freezing as much of the ice as possible in the freezer produced ice cream of a smoother texture.

[Experiments in dairying at the Connecticut Storrs Station] (*Connecticut Storrs Sta. Bul. 171 (1931), pp. 20–22*).—Three studies are here noted.

Effects of freezing on milk.—Continuing this study (E. S. R., 63, p. 168), frozen milk was held at +10 and −14° F. for 4 months. The milk had been homogenized at 2,000 and 4,000 lbs. pressure. When held at −14° there was only a slight precipitation of casein, while at 10° the precipitation of casein was heavy. At a holding temperature of −14° the homogenizing pressure had no influence on casein precipitation, but at 10° the homogenizing of milk at 2,000 lbs. pressure caused a slightly greater casein precipitation when compared with the check lot. Homogenization at 4,000 lbs. pressure caused the precipitation of casein to occur about twice as rapidly as when the homogenizing pressure was 2,000 lbs.

Chemical investigation of gargety milk.—An analysis of 56 samples of gargety milk showed that the total nitrogen content varied from 332.3 to 1,150.1 mg. per 100 cc., with an average of 643.75 mg. The total nitrogen content of normal milk was 485.56 mg. per 100 cc. The amino nitrogen content of normal milk was 12.36 mg. and of gargety milk 36.55 mg. per 100 cc.

The effect of homogenizing pressure on the body and texture of ice cream.—Increasing the homogenizing pressure and reducing the gelatin content of an ice cream mix produced a smooth, velvety body in the resultant ice cream. It required 1.5 kw. of electricity to homogenize the 50-gal. mix at 2,500 lbs. pressure and 2 kw. to homogenize a similar mix at 3,000 lbs. pressure. The additional power would cost 1.5 cts. at a 3-ct. power rate, while reducing the percentage of gelatin from 0.4 to 0.1 per cent would effect a saving of 1.425 lbs. of gelatin per 50-gal. batch, which at 40 cts. per pound of gelatin would save 55.5 cts.

[Experiments in dairying in Michigan] (*Michigan Sta. Bien. Rpt. 1929–30, p. 23*).—The results of three studies are noted.

The effects of butter, condensed milk, and skim milk powder in ice cream mixes.—In a 10 per cent fat mix containing 10.5 per cent of serum solids, the whipping properties were not affected when butter supplied up to 20 per cent of the total fat. When butter was used to supply from 80 to 100 per cent of the fat the whipping properties were improved, but the body of such ice cream was slightly coarse, the melting resistance was reduced, and the clumping of fat globules increased. Using skim milk powder in place of condensed skim milk as a source of serum solids improved the whipping properties and had no effect on body, texture, or melting resistance.

The effectiveness of dairy cleansers and cleaners.—The modified sodas were found to be the most satisfactory general-purpose cleaners in hard water. Trisodium phosphate was a good water softener, but was not satisfactory in an emulsion of butterfat and had a bad effect on tinware.

The comparative value of factors which affect clean milk production.—In this study it was found that milk drawn in unsterilized pails showed a marked increase in bacterial count over that drawn in sterilized pails. The use of small-top pails was effective for holding down bacterial counts when the flanks and udder of the cow were dirty, but when the cow was clean little difference was noted between small-top pails and open-top pails.

VETERINARY MEDICINE

[Report of work in veterinary science at the California Station] (*California Sta. Rpt. 1930, pp. 98–101*).—Experimental work conducted by the station cooperatively with the U. S. D. A. Bureau of Animal Industry on bovine in-

fectious abortion tends to indicate that cultures of *Brucella abortus* freshly isolated from cows vary markedly, and that the phenomenon of dissociation in vitro into *R* and *S* types of colonies is of considerable significance. The *R* types are self-agglutinating and relatively nonvirulent and nonantigenic. These observations are said to have had an immediate use in the technic of the agglutination test and its application to the control of cattle diseases. A correlation made of milk sera with that of blood sera in 727 cases in cooperation with a large commercial dairy failed to show any in which there was agglutination in the milk serum when the blood serum was negative. On the other hand, 18 blood sera gave an agglutination of over 1:50 with cattle in which there was no agglutination in the milk sera at 1:12.5.

The vaccination of cattle against tuberculosis with B. C. G., which has been practiced annually for four years in a dairy herd severely infected with tuberculosis, indicates that the method has furnished protection against the development of clinical cases of tuberculosis. B. C. G. has also been found to be somewhat effective in protecting calves against a fatal termination from massive artificial infection in controlled experiments conducted at Berkeley. The resistance is not sufficient to prevent the penetration of the walls of the alimentary tract by virulent tubercle bacilli. The chief protective effect of the vaccine seems to be in retarding the extension of tuberculous processes occurring from infection received subsequent to vaccination. In experiments at Davis on swine the protective effect, if any, has been less pronounced than in calves.

Work with anaplasmosis in cattle by W. H. Boynton has shown that animals which have apparently recovered remain carriers of the disease for at least two years (E. S. R., 62, p. 561).

A vaccine for hog cholera which has held its potency for one year was developed by Boynton.

Coccidioidal granuloma, which affects human beings, was found by J. Traum in two cattle in Los Angeles County and in one cow in Alameda County.

Chickens were observed by W. R. Hinshaw to be an important factor in the transmission of fowl typhoid to turkeys.

A study of infectious bronchitis by Hinshaw in cooperation with H. W. Graybill and E. E. Jones has shown that congestion of poultry ranches and the continuous brooding of chicks for replacements are probably the most important factors in the spread and continuation of this disease on such ranches. Once the disease has been introduced it has occurred yearly on practically every ranch in the congested areas visited in this survey, while in districts less densely populated with poultry it occurs sporadically and has not been as serious a problem, since the prevention of its recurrence after thorough cleaning and disinfection has been found possible. The buying of birds other than day-old chicks for replacements from infected areas has been the principal means of introduction of the disease into new sections. Laboratory studies by J. R. Beach indicate that the virus of the disease exists in the abdominal organs as well as in the tracheal exudate. Attempts by G. Kernohan to produce infectious bronchitis by filtrates or by cultures of microorganisms from the tracheal exudate have given negative results.

In the study of coccidiosis by Beach and S. T. Michael at Berkeley and by Kernohan at Petaluma nothing better than the 40 per cent milk mash diet has been discovered. It was found by Kernohan that 95 per cent of the paralytic birds examined at Petaluma were affected with chronic coccidiosis. The feeding of the 40 per cent milk mash was of benefit only in those flocks in which the diagnosis of chronic coccidiosis was made early.

The application of the rapid whole blood test by Beach and Michael in two flocks consisting of 3,714 fowls indicated that it is not a satisfactory substitute for the serum agglutination test for pullorum disease. It is said to have become evident as the result of 10 years of blood testing of breeding fowls for pullorum disease at Berkeley and 3 years' testing at the Los Angeles laboratory that ultimate eradication can be accomplished only by testing at intervals of a month or six weeks until the flock is free from infection.

A list is given of the most important poultry diseases diagnosed at the Los Angeles laboratory, by Graybill, arranged in the order of frequency.

Studies of diseases of sheep by J. A. Howarth at Davis led to the discovery of the specific causes of enzootic lameness in lambs and infectious postular dermatitis in sheep and goats, these diseases having been proved to be identical with diseases recently described in European literature.

[Work in animal pathology and bacteriology at the Michigan Station] (*Michigan Sta. Bien. Rpt. 1929–30, pp. 9–12*).—Under the heading of tissue reaction to the abortion bacillus, it is pointed out that a morphological study of the lesions has shown a considerable similarity between the early stage of experimental abortion disease in guinea pigs and the early stage of tuberculosis. It is possible by repeated injections of certain dyes or coloring substances into an animal during life to stain or color certain cell groups without any evidence of materially influencing their behavior toward other injurious agents gaining entrance into the tissues. In such animals various kinds of bacterial infection may be experimentally produced and the behavior of the colored cells toward the infection observed. The station has used this technic in the study of abortion bacillus disease in guinea pigs with the results above stated. A study made of the abortion bacillus disease in the monkey is said to indicate clearly that this animal is susceptible to the bovine strain of the abortion bacillus, although more susceptible to the swine strain. The importance of abortion disease and its control by vaccination led to the testing of 10 different so-called nonvirulent abortion vaccines, none of which that was found viable was nonvirulent for guinea pigs.

In a study of the histopathology and bacteriology of the udders of 135 cows thus far completed, 65 were found to be reactors to the agglutination test for abortion disease, and 69 per cent of these reactors showed *Brucella abortus* in the udder associated with pathological changes. A summary is given of the breeding record of an abortion diseased herd which varied in size from 100 to 150 animals of breeding age, in which monthly agglutination tests were made during the past 5 years. Approximately 50 per cent of all animals reacted in a titer of 1 to 100 or higher to the agglutination test for infectious abortion. Of the reactors to the agglutination tests 6 per cent never became pregnant and were disposed of because of sterility, and 67 per cent of the reactors have aborted. Of the aborters 64 per cent aborted only once, but 28 per cent of these were thereafter sterile. Each of the remaining one time aborters produced an average of 3.8 calves during her lifetime. Of these one time aborters remaining in the herd, 87 per cent remained positive to the tests as long as they remained in the herd. Twenty-three per cent of the aborters aborted twice, and 33 per cent of these were thereafter sterile. Of the two time aborters 90 per cent remained positive as long as they lived. Five per cent of the aborters aborted three times, 5 per cent four times, and 2 per cent five times.

Further studies of the use of an avirulent culture for the vaccination of cattle against infectious abortion confirm previous findings in that the vaccine appears to be perfectly harmless and comparatively effective in preventing the disease. In an epidemiological study, conducted in cooperation with the Michi-

gan State Department of Health and made of a large group of people exposed to infection by the infectious abortion germ, it is shown that human beings have a high degree of immunity to infection by the cattle abortion organism.

Very satisfactory results are said to have been obtained from the use of a living culture streptococcus vaccine for mastitis of cattle. The vaccine should be autogenous, but due to the short-lived nature of the organism it would be very difficult to commercialize such vaccines.

Encouraging results were obtained from the use of colloidal iodine in the treatment of turkeys for the prevention and cure of blackhead and the large Hymenolepis tapeworm. Similarly promising results were obtained from the use of colloidal iodine in the control of coccidiosis in poultry and also in the control of pinworms (*Enterobius vermicularis*) in man. A contribution was made to the conservation of colloidal iodine by the addition of iron chloride. Some very hopeful results are said to have been secured from the use of orthophenylphenol in the treatment of external parasites of poultry.

Evidence was obtained to show that at least some of the outbreaks of so-called range paralysis of poultry are due to or associated with coccidiosis. Gratifying results were obtained from the use of a vaccine for fowl pox and similarly from the use of a bacterin for roup.

Mention is made of the perfection of a medium for the isolation of *Salmonella pullorum* which contains brilliant green, a bacteriostatic dye.

Poisonous range plants, C. E. FLEMING ET AL. (*Nevada Sta. Rpt. 1930, pp. 12, 13*).—Work with western goldenrod (*Solidago spectabilis*), in which it was fed to sheep and cattle, confirmed the conclusions drawn from earlier tests, namely, that the active poisonous principle is not present in the leaves until late in the summer. Up to August, grazing animals may eat this goldenrod without danger, but the poisonous matter begins to develop at the time when the flower heads are forming and the plant is then dangerous for the remainder of the summer and autumn.

Tests of arrow grass (*Triglochin maritima*) have shown clearly that the poisonous principle may be retained in the dried grass and that the hay is often dangerous, thus confirming earlier conclusions (E. S. R., 41, p. 77). It was found, however, that the method of drying and the length of time between drying and feeding affect the outcome, the active poisonous principle being partly lost in the process of drying, and under certain conditions it may be so reduced in quantity that the hay is no longer dangerous.

The work with fitweed (*Capnoides caseana*) has been noted (E. S. R., 65, p. 668).

Some experiments on the supposed toxicity of the blood of animals subjected to starvation [trans. title], M. LASKOWSKI (*Pam. Państ. Inst. Nauk. Gosp. Wiejsk. Pulawach* (*Mém. Inst. Natl. Polon. Écon. Rurale Pulawy*), *10* (*1929*), *No. 2, pp. 574–587; Eng. abs., pp. 585–587*).—In contradiction to the results reported by P. Carnot and E. Terris,[1] investigation fails to support the conclusion that toxic substances are formed in the blood of starved animals.

On the hemotoxin in Sarcosporidia, S. SATO (*Zentbl. Bakt.* [*etc.*], *1. Abt., Orig., 118* (*1930*), *No. 3–4, pp. 189–196*).—The author finds that sarcosporidiotoxin contains hemolytic and hemagglutinative principles. It is concluded from the experimental data presented that the hemolysis-inhibiting substance (albumin fraction) acts directly against the hemolytic principle, while the hemagglutination-inhibiting substance (globulin fraction) first combines with the erythrocytes and subsequently inhibits hemagglutination.

[1] Compt. Rend. Soc. Biol. [Paris], 90 (1924), pp. 739–741; 91 (1924), pp. 446–448, fig. 1; 93 (1925), pp. 606–608, figs. 2.

The resistance of the virus of Borna disease to drying and experiments in protective inoculation with dried virulent brain material [trans. title], W. Zwick and J. Witte (*Berlin. Tierärztl. Wchnschr.*, *47* (*1931*), *No. 3*, *pp. 33–35*; *abs. in Vet. Bul.*, *1* (*1931*), *No. 1*, *p. 55*).—After referring to previous work in which it was found that Borna virus from affected rabbits was killed in a short time when the brain tissue containing it was dried, experiments are reported in which very different results were obtained with various strains of the virus in similar material.

Isolation of Brucella abortus from a human fetus, C. M. Carpenter and R. Boak (*Jour. Amer. Med. Assoc.*, *96* (*1931*), *No. 15*, *pp. 1212–1216*).—The authors report upon the isolation of the bovine strain of *B. abortus* from an aborted human fetus, which is said to be the first to be recorded. The report is presented in connection with a list of 38 references to the literature, which is reviewed at length.

Spontaneous pasteurellosis in mice [*trans. title*], A. Clarenburg (*Tijdschr. Diergeneesk.*, *58* (*1931*), *No. 9*, *pp. 473–477*; *Ger.*, *Eng.*, *Fr. abs.*, *p. 477*).—The author reports upon a mortality among mice due to a spontaneous infection with a member of the hemorrhagic septicemia group. Mice and rabbits appeared to be highly susceptible to artificial infection, while rats, guinea pigs, pigeons, and fowls were resistant.

Observations on ticks and tick-borne diseases, E. A. Lewis (*Kenya Colony Dept. Agr. Bul. 2* (*1931*), *pp. 15*, *figs. 2*).—A practical summary of information.

Tick toxin and tick paralysis [trans. title], P. Regendanz and E. Reichenow (*Arch. Schiffs u. Tropen Hyg.*, *35* (*1931*), *No. 5*, *pp. 255–273*, *figs. 3*).—The author reports that the brown dog tick contains a toxin that is formed during its embryonic development, especially in the ovaries. Neither the larvae nor the adults contain the toxin in demonstrable amounts.

Dextrose in synthetic media for the tubercle bacillus, R. R. Henley (*Amer. Rev. Tuberc.*, *19* (*1929*), *No. 6*, *pp. 660–663*).—In the investigations here reported the author found that the synthetic media containing dextrose afforded a more rapid growth of *Bacillus tuberculosis* than the same media free from sugar. The results are said to confirm the recently reported observations of A. Frouin and M. Guillaumie,[3] since it was found that the growth of *B. tuberculosis* upon synthetic media was influenced by the relative proportion as well as by the actual amount of the different constituents of the media. A medium is described which has afforded in six weeks yields of bacteria weighing 2 gm., dry weight, per 100 cc. of culture fluid.

Ammonium malate as a source of nitrogen for tubercle bacilli in cultures, R. R. Henley and P. W. LeDuc (*Amer. Rev. Tuberc.*, *22* (*1930*), *No. 5*, *pp. 568–570*).—This is a report of a study made of a variety of ammonium compounds while in search for an inexpensive substitute for asparagin, generally used as the chief source of nitrogen in synthetic culture media for *Bacillus tuberculosis*. A synthetic medium described by Henley, as above noted, was used as a basis for the comparison.

In the work reported the authors substituted for the asparagin in the formula a single ammonium salt, using urea and the ammonium salts of carbonic, malic, maleic, aspartic, citric, fumaric, lactic, tartaric, and succinic acids. The culture media containing urea, as well as those containing ammonium salts of carbonic acid and maleic acid, afforded only very slight growth of bacteria. The media containing the ammonium salts of aspartic, citric, fumaric, lactic, tartaric, and succinic acids afforded fair amounts of growth,

[3] Ann. Inst. Pasteur, 42 (1928), pp. 667–694.

but in no case was the growth more than approximately half as great as that obtained from the regular asparagin medium. The ammonium salt of malic acid alone showed an efficiency approaching that of asparagin as a source of nitrogen for tubercle bacilli. It is pointed out that malic acid may be obtained in a high degree of purity at a cost of about 55 cts. a pound, whereas asparagin costs approximately $20 a pound.

The culture medium is prepared as follows: To produce 1,000 cc. of culture medium 10 gm. of malic acid are dissolved in about 500 cc. of water and neutralized to litmus with ammonium hydroxide. The other constituents are then dissolved in the order given in the formula and the solution diluted to 1,000 cc. The medium is sterilized in the autoclave under a pressure of 10 to 12 lbs. for 20 minutes. The reaction of the completed medium is approximately pH 7, and therefore requires no adjustment.

A study of bovine coccidiosis, I. D. Wilson (*Virginia Sta. Tech. Bul. 42* (*1931*), *pp. 42, figs. 20*).—In the introduction to this account it is pointed out that bovine coccidiosis is nearly universal in its distribution in the United States, and that in parts of Virginia it is so prevalent in young cattle as to be almost a limiting factor in the beef cattle industry, existing as it does on most farms. A review of the literature is presented in connection with a list of 59 titles cited and 56 additional titles to the literature examined. This is followed by a report of the experimental work conducted (pp. 11–24), which includes the description of a new species, *Eimeria cylindrica*, for which the short time required by the oocyst for sporulation is the most outstanding physiologic characteristic. *E. zurnii* is the species most common, although *E. smithi* and *E. cylindrica* are usually present.

"Cross-infection experiments with swine and goats indicate that the species of Eimeria used in this study are highly host specific. The maximum thermal death point of nonsporulated oocysts of *E. zurnii*, *E. smithi*, and *E. cylindrica* is about 55° C. with an exposure of 10 minutes. Winter temperatures as encountered in Iowa destroyed both sporulated and nonsporulated oocysts of three species of bovine coccidia. A temperature of −6°, after 35 days' exposure, slightly reduced the number of nonsporulated oocysts of *E. zurnii* and *E. smithi* that developed at 25–30°. Such treatment made a much greater difference in the number of *E. cylindrica* oocysts that developed. Centrifuging nonsporulated oocysts at 1,000 r. p. m. for 10 minutes did not appear to reduce the number or retard the rate of sporulation of the three species of bovine coccidia that have been studied.

"Nonsporulated bovine coccidial oocysts are readily destroyed by mercuric chloride, phenol, liquor cresolis compound, and formaldehyde, but were not destroyed when incubated in 2 per cent potassium dichromate or 2 per cent copper sulfate. Drying in the direct rays of the sun for 24 hours killed Eimeria oocysts of bovine origin. Drying, out of the sun, was less effective. There is indication that putrefaction readily destroys nonsporulated oocysts of bovine origin in a short time.

"Fully sporulated coccidia of bovine origin proved difficult or impossible to digest by ordinary means in vitro or with young rats. Young calves fed on powdered skim milk were not immune to bovine coccidia, although they were somewhat resistant, probably because the oocysts did not remain in the body long enough for digestion. When fully sporulated oocysts were given to susceptible young calves, nonsporulated oocysts appeared in the feces in about 7 days. About 5 days later there was a decline in the number eliminated, which was followed by a secondary rise which reached its peak about 18 days after the original infective dose was given. During the secondary rise, the number eliminated was twice or three times as great as during the primary period.

"An acute attack of bovine coccidiosis may end in the animal becoming a chronic carrier for an indefinite length of time. Possibly resistance or immunity is a greater limiting factor to the disease than the fact that there may be a limited number of asexual generations of the organism. The strict sanitary precautions practiced in this study prevented the spread of coccidiosis to susceptible calves."

The puerperal hemoglobinemia of the bovine [trans. title], A. HJÄRRE (*Acta Path. et Microbiol. Scand., Sup. 7 (1930), pp. 150, pls. 29, figs. 3*).—This is a report of a patho-anatomical study of puerperal hemoglobinemia of the bovine, with particular reference to the pathogenesis of the alterations of the liver. A five-page list of references to the literature is included.

Hemorrhagic disease in cattle, E. RECORDS and L. R. VAWTER (*Nevada Sta. Rpt. 1930, pp. 15, 16*).—In continuation of work with this disease (E. S. R., 63, p. 572), a study of the natural means of spread was commenced with a view to prevention. There is considered to be good reason for assuming that there is some connection between the presence of liver flukes in the affected animals and the onset of the disease. Tests made in 1929–30 seem to show that it can not be transmitted to an animal by feeding quantities of virulent cultures. They indicate that no matter how heavily drinking water may be contaminated by the germs the disease does not spread from animal to animal without the action of some other factor. "Apparently this factor must be some agent or agency that breaks down minute bits of liver tissue and causes the death of groups of liver cells. At these points of injury germs find lodgment and the disease starts. These facts point to that stage of the liver fluke in which it first enters the liver and before it has penetrated to the bile ducts as a possible intermediary agent in spreading the disease among animals that swallow the germs in contaminated food and water."

[Work in Connecticut with infectious abortion in cattle] (*Connecticut Storrs Sta. Bul. 171 (1931), pp. 15, 16, 19*).—Reference is first made to the establishment and maintenance of abortion-free herds in the State. During the year, 29 new herds were placed under test. Four were found free from infection on the initial test and 7 others, from which the reactors had been removed, were free on the last test of the year. At the time of writing, there were 80 herds, representing a total of about 2,300 head, under observation. The disease had been completely eradicated from 35 herds and nearly so from 16 others.

Studies on microbic dissociation in the abortus-melitensis group have shown that antisera prepared by the injection of ordinary *Brucella abortus* cells will agglutinate ordinary cells but will not agglutinate mucoid cells, whereas antisera prepared by injecting mucoid cells will agglutinate both mucoid and ordinary cells of *B. abortus*. This suggests that the mucoid forms of *B. abortus* and possibly *B. melitensis* possess a double antigen complex as compared with only one complex in the normal type. In common with other capsulated bacteria, the mucoid cells have poor agglutinogenic properties, and rabbits which have received injections show the presence of agglutinins only after repeated large doses.

There was an increase in the number of human blood samples submitted for diagnosis for the disease in man, 51 of the 325 samples received having agglutinated *B. abortus* antigen in dilutions of 1:100 or higher, 64 in dilutions of 1:50, and 74 in dilutions of 1:25. In 20 of 26 cases on which clinical data were available the agglutinin titer of the patient's serum was greater than 1:1,000, and in only 2 cases less than 1:100.

In control and eradication work, conducted with a view to determining the practicability of maintaining a herd free from abortion infection, the agglutination reactions of all animals over 6 months of age in the herd (178

females) during the last 4.5 years were studied. In making the 1,798 agglutination tests the laboratory continued to use dilutions of 1:25, 1:50, 1:75, 1:100, 1:150, and 1:300, without a single positive reaction having occurred. In this herd, which has been free from abortion since 1925, no particular precautions have been taken other than in the introduction of animals, the barns having been open to visitors at any and all times. The results are considered to show clearly that full positive reactions do not occur in a clean herd, and to demonstrate that some nonspecific reactions, usually slight, may occur in the lower dilutions, particularly the 1:25 and 1:50.

Infectious mastitis (*Connecticut Storrs Sta. Bul. 171 (1931), p. 17*).—The use of autogenous herd bacterins as a means of preventing the spread of bovine infectious mastitis was practiced in three commercial dairy herds during the course of 2 years, no severe cases of mastitis having occurred in two during the last 18 months. An occasional case of mastitis occurred in the third herd. The predominant kinds of bacteria recovered from 102 milk samples from active cases of mastitis received during the past 2 years are as follows: Beta streptococci 57, alpha streptococci 31, gamma streptococci 6, staphylococci 11, diplococci 4, and negative 3. It was observed that one or several of these organisms may be the cause of udder inflammation in a given herd.

The manner of transmission of bovine theileriosis in North Africa by the tick Hyalomma mauritanicum [trans. title], E. Sergent, A. Donatien, L. Parrot, and F. Lestoquard (*Compt. Rend. Acad. Sci. [Paris], 192 (1931), No. 5, pp. 253–255*).—It was found in experimental work in Algeria with *H. mauritanicum*, a two-host tick, that the larvae and nymphs of this tick which develop on the first host become infected with *Theileria dispar* through engorging blood of an infected bovine and in the adult stage transmit the infection to the second host. *T. dispar* is not transmitted through the egg.

The kidney worm of pigs, F. H. S. Roberts (*Queensland Agr. Jour., 35 (1931), No. 5, pp. 290–302, figs. 3*).—An extended account is given of *Stephanurus dentatus* Dies., particularly as applied to Queensland, where it is the most frequently encountered of the 17 species of internal parasites of swine.

Eleventh annual report on eradication of pullorum disease in Massachusetts, 1930–31, H. Van Roekel et al. (*Massachusetts Sta. Control Ser. Bul. 58 (1931), pp. 24, figs. 14*).—This eleventh annual report (E. S. R., 63, p. 577) contains a brief discussion of pullorum disease, losses encountered, means of spread, and methods of combating the disease. The tables give a comparison of the percentage of reactors detected among females and males, distribution of tests and reactors (by counties and by breeds), tested fowl other than chickens (2,099 in number, of which none were reactors), consecutive annual testing v. single and intermittent testing, nonreacting and positive flocks classified by counties, comparison of 1929–30 and 1930–31 testing, and an 11-year testing summary.

The 1930–31 results show increases in the number of tested birds and in the number of tests. The average percentage of infection was reduced to the lowest attained during the 11-year testing period. The number of birds in 100 per cent tested, nonreacting flocks has increased. Suggestions are made to aid poultrymen in establishing and maintaining pullorum disease-free flocks.

Sorehead (fowl pox) control in baby chicks, C. M. Bice (*Hawaii Sta. Rpt. 1930, pp. 35, 36*).—Fowl pox, commonly known in Hawaii as sorehead, is probably the most destructive poultry disease met with in the islands, the mortality of chicks from this disease ranging from approximately 25 to 45 per cent of those hatched. With a view to determining the manner of transmission to baby chicks, 1,000 day-old chicks were divided into groups of 200 each and kept under varied conditions of housing and yarding. The chicks were kept

confined in 5 brooder houses, 3 of which were entirely mosquito proof, until 13 weeks of age, when they were transferred to the laying house or to small colony houses for further study, 25 chicks being placed in each of 2 small colony houses, 1 of which (but not the run) was mosquito proof. With the exception of the unscreened colony house, the chicks were in each instance kept off the ground by means of 0.5-in. mesh hardware wire or a concrete floor. It is pointed out that characteristic sorehead lesions appear 7 days after the mosquito has fed on the chick. The results appeared to confirm earlier experiments,[8] indicating that the affection is transmitted to baby chicks by mosquitoes and may be prevented by screening the runs and houses.

Spirochetosis of fowls in Northern Caucasus [trans. title], W. L. YAKIMOFF and E. F. RASTEGAIEFF (*Zentbl. Bakt. [etc.], 1. Abt., Orig., 117 (1930), No. 4-5, pp. 223-240, fig. 1*).—The authors have found that in Piatigorsk the spirochetosis of fowls is transmitted by the fowl tick, the mite *Dermanyssus avium* not being implicated. The incubation period following infection by the tick is from 4 to 7 days.

Blackhead of turkeys (*Connecticut Storrs Sta. Bul. 171 (1931), pp. 16, 17*).—The work with blackhead of turkeys was conducted in continuation of that by Rettger, Kirkpatrick, and McAlpine, previously noted (E. S. R., 61, p. 475). The findings supported the earlier conclusions that weekly rotation is an important means of reducing blackhead mortality to a low and insignificant rate. The experiment also emphasized the advisability of allowing the ground to rest during the winter and spring months. Additional information was obtained to incriminate chickens as gross carriers of blackhead.

AGRICULTURAL ENGINEERING

[Agricultural engineering investigations at the California Station] (*California Sta. Rpt. 1930, pp. 47-49*).—Studies by J. D. Long of adobe construction showed the walls of a rammed earth poultry house built in 1927 to be intact and the finish coats of stucco and mud plaster to weather unsatisfactorily, while the painted surfaces blistered. Rammed earth floors were satisfactory when kept dry. Wall sections made with 1 part of lime to 6 parts of soil were smoother than walls built with an admixture of gravel.

In studies of fencing materials, Long reported that concrete posts made from lean mixtures showed deterioration cracks from rusting of reinforcing and metal expansion after five years of use.

Field tests of burners for the control of aphis infestation in alfalfa by H. B. Walker, F. Hall, and B. A. Madson of the station and O. K. Hedden and R. A. Blanchard of the U. S. D. A. Bureaus of Public Roads and Entomology, respectively, showed that lighter applications of fuel, stove oil and Diesel oil, were satisfactory under favorable weather conditions.

Studies by A. H. Hoffman and C. L. Barbee on bearing wear as affected by character and condition of the lubricant showed a ratio of 1.556:1 between the amounts of wear with and without an oil filter in a 25,000-mile test.

Studies of methods of harvesting rice by E. J. Stirniman and R. Bainer showed that the windrow pick-up method is satisfactory from the mechanical standpoint, but that long exposure of windrowed grain to hot sunshine caused checking of kernels with a resulting loss of head rice. It was found that the condition of the straw rather than the moisture in the grain was the limiting factor in handling rice with the combine. Studies by Bainer on the relation of temperature and moisture-content variations to the checking of rice

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[8] Baby Chick Disease Control. Hawaii Univ., Agr. Studies No. 10 (1928), pp. 8, figs. 4.

showed that the structure of rice kernels was broken down under all moisture conditions when subjected to drying temperatures in excess of 100° F. A temperature of 120° lowered the milling quality from 3 to 7 per cent more than did a temperature of 100°. Rice dried under average room temperatures, varying from 65 to 95°, showed from 2 to 5 per cent less head rice than when dried at a constant temperature of 100°.

In studies of dairy equipment sterilization, R. L. Perry found that compressed natural gas, when used for heating sterilizers, showed a consumption of 1.4 lbs. per sterilization as compared with 1.7 lbs. of kerosene. He also found that the sharpening of ice cream freezer blades by filing reduced the power required from 6 to 18 per cent.

[Agricultural engineering investigations at the Michigan Station] (*Michigan Sta. Bien. Rpt. 1929–30, pp. 6, 7*).—Tests on the use of a steel alloy, or high speed steel, for the treatment of plowshares are reported to indicate greatly increased wearing properties for the shares where the alloy is used.

The study of combine harvesters showed that where seedings or weeds cause green material to be thrown over into the threshed grain the excessive moisture may cause trouble in drying. Apparently the windrower obviates this difficulty.

Traction loss tests on tracklaying and wheel types of tractors on soft plowed ground showed that the power losses by the tracklaying types are small, while the wheel slippage of the wheel type entails serious power losses.

Experiments with a unit dryer for seed corn showed that a shallow, bottomless box with the sides insulated with two layers of Celotex and a 0.5-in. air space and the top insulated with three layers of Celotex and two 0.5-in. air spaces, and having electrically supplied heat, was very effective.

In tests of the use of heat for maintaining egg production through periods of severe cold, it was found that heat may be advantageously applied in the floor by electricity, thus keeping the litter dry as well as modifying the room temperature.

In tests of dairy barn ventilation, the results indicated that the cost of electric ventilating equipment, including installation and cost of current, may be considerably less than the annual cost of cupolas and flues on a natural air flow type of installation.

Tests of whitewash and cold water paints over a 1-year period showed them to have little value as wood protectors.

The progress results of potato warehouse ventilation by means of forced draft are briefly presented, no conclusions being drawn.

Geology and ground water resources of western Sandoval County, New Mexico, B. C. Renick (*U. S. Geol. Survey, Water-Supply Paper 620 (1931), pp. VI+117, pls. 10, figs. 3*).—This report, prepared in cooperation with the State engineer of New Mexico, deals with the geology and ground water resources of an area covering about 1,150 square miles in the western part of Sandoval County, N. Mex.

The investigation was made primarily to determine artesian prospects of the area. It was found that, although flowing wells are not in general to be expected in the area, there are good prospects of obtaining satisfactory supplies of water for domestic and stock uses and probably also for irrigating gardens.

[Irrigation investigations at the California Station] (*California Sta. Rpt. 1930, pp. 79–81*).—Progress results of studies of soil, plant, and moisture relations, consumptive irrigation requirements, irrigation methods, irrigation pumping, and irrigation structures are briefly summarized, without specific conclusions.

Highways in the United States of America and its possessions (*U. S. Dept. Agr., Bur. Pub. Roads, 1931, pp. 12+[8], illus. 14*).—This contribution of

the Bureau of Public Roads, prepared for the International Colonial and Overseas Exposition, Paris, 1931, presents a brief history of highway development in the continental United States from the colonial period to the present time.

Public Roads, [June and July, 1931] (*U. S. Dept. Agr., Public Roads, 12 (1931), Nos. 4, pp. 89–116+[2], figs. 40; 5, pp. 117–144+[2], figs. 35*).—These numbers of this periodical contain the status of Federal-aid and emergency road construction as of May 31 and June 30, 1931, respectively, together with the following articles:

No. 4.—Subgrade Soil Constants, Their Significance, and Their Application in Practice, by C. A. Hogentogler, A. M. Wintermyer, and E. A. Willis (pp. 89–108); and The Effect of Water-Gas Tar on the Strength and Alkali Resistance of Concrete, by E. C. E. Lord (pp. 109–116).

No. 5.—The Subgrade Soil Constants, Their Significance, and Their Application in Practice, II, III, by C. A. Hogentogler, A. M. Wintermyer, and E. A. Willis.

Effect of extractives on the strength of wood, R. F. Luxford (*Jour. Agr. Research [U. S.], 42 (1931), No. 12, pp. 801–826, figs. 2*).—Studies conducted at the U. S. D. A. Forest Products Laboratory are reported. Four distinct methods were used to determine the effect of extractives on the strength of redwood, western red cedar, and black locust, namely, (1) sapwood was compared with heartwood, (2) redwood heartwood from which the extractives were partly removed by forcing cold water through in the direction of the grain was compared with adjoining unextracted heartwood, (3) the outer portion of a kiln-dried redwood block in which the concentration of extractives had been increased by the transfer that is normal during kiln-drying was compared with an adjoining interior portion of lower extractive content, and (4) sapwood of redwood soaked in redwood extractives was compared with normal sapwood.

The results showed that extractives affect the strength properties of these woods to an extent depending on the amount of extractives, the species of wood, the moisture condition of the piece, and the mechanical properties under consideration. Of the properties considered, the compressive strength parallel to the grain showed the greatest increase because of the normal infiltration of extractives in the change of sapwood into heartwood. The modulus of rupture was next in order of effect and shock resistance the last. In fact, the shock resistance appeared to be actually lowered by extractives under some conditions. Extractives changed the strength of western red cedar less than that of black locust, although black locust has a smaller percentage of extractives.

The effect of blue stain on the penetration and absorption of preservatives, W. M. Saling (*Amer. Wood-Preservers' Assoc. Proc., 26 (1930), pp. 183–196, fig. 1*).—Studies conducted at the University of Idaho showed that, with moisture controlled and specific gravity comparable, the penetration and absorption of zinc chloride increases with an increase in the degree of blue stain in western yellow pine. Zinc chloride had a greater absorption than creosote for the different grades of stain, while the penetration of the two preservatives was comparable. Loblolly pine showed a greater penetration and absorption in the blued than in the unblued stock. Zinc chloride had the greater absorption for each grade of stain but about equal penetration.

A laboratory method for comparing the efficiencies of preservatives for structural timber, F. H. Rhodes and F. T. Gardner (*Amer. Wood-Preservers' Assoc. Proc., 26 (1930), pp. 71–75*).—Studies conducted at Cornell University

showed that of the three general classes of components of coal-tar creosote oil, the hydrocarbons and the tar acids have much higher fungicidal powers than do the tar bases. The hydrocarbons in coal-tar creosote oil are fully as effective fungicides as are the tar acids of similar distillation ranges.

Within each separate group of compounds, the fungicidal power decreases as the boiling point increases. The tar acids wet wood a great deal more readily than do the neutral hydrocarbons and are less volatile from wood.

Service records of treated and untreated fence posts, R. M. Wirka (*Amer. Wood-Preservers' Assoc. Proc., 26 (1930), pp. 237–254*).—In a contribution from the U. S. D. A. Forest Products Laboratory, a summary is given of results of experiments conducted at different agricultural experiment stations and other research institutions.

The conclusion is drawn that the life of fence posts is dependent upon such factors as species, percentage of heartwood and sapwood, size, form, preservative treament, and soil and climatic conditions. The radial penetration of the preservative usually is a better criterion of the value of the treatment than the absorption.

The life of the fence posts made from nondurable species can generally be increased to 20 or more years by giving them a thorough hot and cold bath butt treatment and a light top treatment with coal-tar creosote. Neither the hot bath nor the cold bath treatment with creosote when used alone can be expected to increase the life of posts as much as the combination hot and cold bath treatment.

Crude petroleum, petroleum distillates, and other nontoxic oils should not be used alone but are often suitable for mixing with coal-tar creosote in quantities up to 50 per cent. Posts given a hot bath in petroleum oil or water-gas tar, followed by a cold bath with coal-tar creosote, can be expected to have a long life. Posts given a good treatment with copper sulfate by the Boucherie process will give good service. The results indicate that charring is of little value.

Fire resistance of wood treated with zinc chloride and diammonium phosphate, G. M. Hunt, T. R. Truax, and C. A. Harrison (*Amer. Wood-Preservers' Assoc. Proc., 26 (1930), pp. 130–159, figs. 17*).—Studies conducted at the U. S. D. A. Forest Products Laboratory showed that the fire tube method of test affords a very useful method of studying the effect of treatment on fire resistance and gives data that are capable of useful analysis. It was also found that the tendency of wood to support combustion and spread flames can be practically eliminated by proper chemical treatments. Of the chemicals studied, the absorptions required for effective flame proofing are much higher than the absorptions of preservative salts required for decay prevention. Both diammonium phosphate and zinc chloride, if used in sufficient quantity, were very effective in reducing the inflammability of wood, the former being more so. The effect of treatment was found to vary noticeably with different species and densities of wood.

Light frame house construction (*Fed. Bd. Vocat. Ed. Bul. 145, rev. (1931), pp. XII+216, pl. 1, figs. 164*).—This publication was prepared by the Federal Board for Vocational Education in cooperation with the National Committee on Wood Utilization. It contains technical information for the use of apprentice and journeymen carpenters, and it includes chapters on framing methods for small buildings; foundation sills and girders; columns, joists, and bridging; walls, partitions, and roofs; floors, sheathing, siding, and shingles; interior trim; miscellaneous items; physical characteristics of wood; and grading of lumber.

Annual report of the department of water supplies and sewage disposal for the year ending June 30, 1930, W. RUDOLFS (*New Jersey Stas. Bul. 521 (1931), pp. 47, figs. 26*).—Preliminary studies on experimental sprinkling filters, by Rudolfs, H. Heukelekian, and N. S. Chamberlin, dealt with four experimental filter media consisting of crushed stone, slag, gravel, and 0.5-in. wire mesh, and having an effective depth of 5 ft.

The gradual building-up process, regardless of filter media, took place over a considerable period with no definite demarcation between the building-up and the regular operation of the filter. In the process of building up the zone of nitrification moved downward, and considerable quantities of ammonia were lost into the air. The greatest suspended solids removal occurred in the roughest media, whereas the greatest ease of unloading was exhibited by the smoothest material. Considerable direct oxidation occurred. The biochemical oxygen demand reduction on the wire mesh amounted to 25 per cent. The greatest *B. coli* reduction occurred in the gravel, followed by slag and crushed stone. The effectiveness of the filters as straining devices was greatest in the upper layers, with particular reference to suspended solids removal, biochemical oxygen demand, and *B. coli* reduction. The percentage of biochemical oxygen demand removal increased with increased loads.

Experiments by Rudolfs on the distribution of protozoa before and after sloughing showed that the numbers of organisms in the film around the stones of the filter bed do not increase in proportion to the increase of thickness or weight of the film. As soon as the thickness of the film decreases, the numbers of organisms increase. The rapid change in numbers of organisms occurs throughout the bed, and free-swimming organisms occur sooner in the effluent than do the stalked protozoa.

The results of other experiments on reaction adjustment of acid sludge by Rudolfs and with Trenton sewage sludge by Rudolfs and I. O. Lacy are also reported. Abstracts of other publications by members of the staff are appended.

AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY

[*Investigations in agricultural economics and rural sociology at the* Connecticut Storrs Station, 1929–30] (*Connecticut Storrs Sta. Bul. 171 (1931), pp. 8–14, 26–28, figs. 5*).—Results of investigations not previously noted are reported on as follows:

In producing hay and silage in the eastern highland, the number of man hours per acre decreased as size of fields increased, the total decrease from the requirements for 0.5- to 10.5-acre fields being plowing 5.12 hours, cultivating 2.06, mowing 1.37, and raking 0.72 hour. The average requirements in cutting silage decreased from 1.45 hours per ton for hand cutting and 0.33 hour for machine cutting with yields of from 4 to 10 tons per acre to 0.84 and 0.23 hour, respectively, with yields of from 10 to 13 tons per acre. Filling silos required 2.53 hours per ton using a tip cart, 2.39 hours using a truck, and 1.9 hours using a low wagon rack. The averages for three cooperators who put into effect the best known methods of organization for silo filling but used no new machinery except a low wagon rack were 10.18 hours per acre and 1.22 hours per ton, as compared with the averages for the region of 31 and 3.28 hours, respectively.

Further study of the characteristics of the rural population of Connecticut showed a consistently high positive relationship between income and home equipment score; a slightly negative relationship (one town with fairly high negative relationship) between rate of mobility of the head of the family and

organizational membership of the family; indicative positive relationships between home equipment and (1) years of schooling and (2) number of newspapers and magazines read by the family; and a marked relationship between home rank score and organizational memberships. The average mobility rate of foreign born was only slightly higher than that for native-born cooperators.

[Investigations in agricultural economics at the Michigan Station, 1928–1930] (*Michigan Sta. Bien. Rpt. 1929–30, pp. 32–34*).—Results of investigations not previously noted are reported on as follows:

An analysis of 482 farm records for the year 1929 collected in cooperation with the extension division showed that in south-central Michigan the 80- to 120-acre farms were the most profitable, followed closely by the 200-acre farms. Farms of 221 acres and over were the least profitable. Insufficient livestock to provide a proper balance between land, labor, feed, and buildings was kept on these larger farms. Farms of from 60 to 140 acres without tractors fared better than those with tractors. The study indicated that the more successful general farms had more livestock than the average; higher returns per cow, sow, ewe, or hen; more alfalfa; higher crop yields; and a better control of farm expenses.

Preliminary results are given of the analysis of records from 92 grape farms for the year 1928 collected in cooperation with the U. S. D. A. Bureau of Agricultural Economics. The results of the study indicated that with the present price trends from 2.5 to 3 tons of grapes per acre must be produced in average seasons if the business is to be on a satisfactory financial basis.

Planning the farm business, G. W. Forster (*North Carolina Sta. Bul. 277 (1931), pp. 55, figs. 16*).—This bulletin, the fourth in the series on farm organization previously noted (E. S. R., 60, p. 678), is based on a study made in cooperation with the North Carolina State Department of Agriculture and the Bureau of Agricultural Economics, U. S. D. A., of 30 representative farms in Northampton County, N. C. Annual inventories, daily records of financial transactions and labor used, periodic feed statement, crop and livestock histories, monthly records of products used in the home, estimates of available family and operator's labor, a pasture report, and farm maps were obtained for each of the farms. Using these data and others on prices of products and costs of labor, fertilizers, etc., for a period of years, tables of prices and yields of crops, estimated investments of different types, implements needed, fertilizer and seed requirements, etc., for a "standard" organization were prepared. Comparison is made of the organization, labor distribution, expenses, receipts, farm income, returns on investment, labor and management wage, etc., on an actual 40-acre farm and the same farm under a suggested reorganization. Standard organizations with estimate of man labor and horse work distribution, receipts, expenses, returns, etc., are given for a 60- and a 90-acre farm. The adjustments between crop and livestock enterprises, between different crops, and between corn and hogs and in the farm layout are discussed.

Studies in taxation in Delaware highway finance, M. M. Daugherty (*Delaware Sta. Bul. 169 (1931), pp. 72, figs. 7*).—This study covers in general the period 1911 to 1930, inclusive. Tables and charts are included and discussed showing by years for the State and each of the three counties the sources of receipts and the expenditures, by purposes, for highway construction, and the taxes per $100 of assessed value spent in each county for maintenance and construction of roads and bond and interest payments. The provisions of the highway act of 1917 creating the State Highway Department and the amendments thereto and the operations under these acts are discussed. The receipts, expenditures, and condition of the sinking fund of the State are analyzed. The problems of the retirement of highway bonds from the sinking

fund and of the future expansion of the State highway system are discussed, and three possible courses of action for the future are outlined.

Tariff rates on representative agricultural products under tariff acts of 1930 and 1922, C. F. WELLS (*U. S. Dept. Agr., Bur. Agr. Econ., 1931, pp. [2]+44*).—This mimeographed tabulation includes the rates in the tariff acts of 1922 and 1930 on both free and dutiable agricultural products specifically mentioned in the acts and the changes made by proclamation of the President under the so-called flexible provision. It furnishes a complete history of each rate from September 21, 1922, to date.

The marketing of Delaware cantaloupes.—II, Consumer demand, H. S. GABRIEL (*Delaware Sta. Bul. 171 (1931), pp. 43, figs. 38*).—This is part 2 of the study previously noted (E. S. R., 63, p. 685) and deals with the marketing problems from the standpoint of the consumer. Section 1 is based on data obtained from visits to 159 stores located in Delaware towns and cities and in Philadelphia, Pa., and from 115 answers to a questionnaire sent to home makers. Charts are included and discussed showing months of maximum sale of cantaloupes and Honey Ball and Honeydew melons, relation of prices of western and eastern cantaloupes, effect of shape on demand, methods used and factors considered by consumers in selecting, defects in purchases, size and color of flesh preferred, meals at which melons were served, number of melons purchased at one time, principal competing fruits, relation of size and price, and percentages discarded by stores, and factors limiting sales are discussed.

Section 2 is based on data obtained by questionnaires from 94 hotels and 111 restaurants. Charts are presented and discussed showing the sources of supplies, preferences for eastern and western cantaloupes and the reasons therefor, by whom selection of cantaloupes was made, size of cantaloupes, type of container and size of package preferred, defects in cantaloupes purchased, methods of serving, number of servings per melon, meals at which served, prices charged, profitableness of serving, advertising, and the relative popularity of cantaloupes and Honeydew melons.

The survey showed that notwithstanding the long distances shipped and the greater transportation charges western melons are able to successfully compete with the eastern product. This is due chiefly to the western melons being consistently of a more uniform size and quality, and if this competition is to be overcome Delaware growers must give special attention to marketing operations.

A survey of some public produce markets in up-state New York, F. P. WEAVER (*New York Cornell Sta. Bul. 525 (1931), pp. 149, figs. 35*).—Survey records were obtained for the year 1929 from 589 growers and 27 trucker-dealers selling produce on the public markets in Albany, Buffalo, Rochester, and Syracuse; from hucksters and intercity truckers buying on these markets; and from a limited number of grocers and keepers of fruit and vegetable stores. The study was made with a view of determining the amount of business, the character of produce handled, the agencies handling it, the source of supply, and the area served. Less detailed information was obtained regarding markets in some smaller cities and also regarding the operation of some markets in neighboring States. The data are analyzed for the four larger markets to determine the amount of sales, total and by groups of commodities and types of buyers; the value of the various classes of products; the regional aspects of the markets; costs of selling; composition of loads and sales outlets; size of loads; distribution of loads throughout the year; potential expansion in supply of vegetables; incomes and expenses of the markets, except Albany; etc. Growers' suggestions for improving the markets are given, and the income and expenses of the Cleveland Growers Marketing

Company's Market, Cleveland, Ohio, covered produce markets in Buffalo, N. Y., Newark, N. J., and in Pennsylvania, and the afternoon produce markets of Niagara Falls, N. Y., and Detroit, Mich., are described. Plans for a market layout, and a program for public market development in up-state New York are included.

Cold-storage holdings (*U. S. Dept. Agr., Statis. Bul. 33 (1931), pp. 36, fig. 1*).—This bulletin brings the information previously noted (E. S. R., 61, p. 85) up to the following dates: December 1, 1929, apples, butter, cheese, eggs, poultry, meats, and lard; and December 15, 1929, fish. Additional tables are included for cold-pack fruit and pears and apples in bushel baskets.

Crops and Markets, [July, 1931] (*U. S. Dept. Agr., Crops and Markets, 8 (1931), No. 7, pp. 241–288, figs. 3*).—Tables, graphs, reports, summaries, and notes of the usual type are included, together with reports of the cotton acreage as of July 1, 1931, by States, the pig survey as of June 1, and cold storage holdings, July 1, 1931.

[Investigations in rural sociology at the Michigan Station, 1928–1930] (*Michigan Sta. Bien. Rpt. 1929–30, pp. 41–47*).—Results of investigations not previously noted are reported on as follows:

Socializing influences of organizations in relation to rural life.—The organizational affiliations of 59,405 individuals were studied. For the 2,548 farm families included, the study showed the following: Fourteen per cent of the men belonged to no formally organized group, 10 per cent belonged to six or more organizations, the average for all men was 2.6 organizations, one-seventh were members of religious groups only, and one-eighth of fraternal groups only; 97 per cent of the men who were members of economic organizations also belonged to noneconomic organizations; farm bureau members averaged 4.4 organizations as compared with 2.1 for nonfarm bureau members; members of the grange belonged to twice as many organizations as nonmembers; 46 per cent of the grange members belonged to the farm bureau as compared with 25 per cent of the nonmembers; 14 per cent of the farm bureau members belonged to the grange as compared with 9 per cent of the nonmembers; the more successful farmers tended to be identified with a larger number and variety of organizations, particularly those having activities county, State, or nation-wide in scope; wives tended strongly to be affiliated with the same number of organizations as their husbands; and children of parents not belonging to any organization were less likely to be members of organizations for youth than were children of parents belonging to several organizations. Village people tended to belong to a slightly larger number and variety of organizations than either farm or city residents. Leaders in organizations belonged to 3.5 times as many organizations as laymen, due to the fact that they tended to belong to more State, national, and international organizations.

The town-country community.—This is a study of the interdependence and association between town and country people in 59 communities in the southern part of the State. In 44 of the communities the population outside the town exceeded that within the town, and in 17 communities it was double or more than double. The service centers for 90 per cent of the farmers were places of less than 2,500 population, and for over 50 per cent of the farmers the service centers had considerably less than 1,000 population. In the average community (town and country) the population had decreased 25 per cent since 1880. With a population of 1,200 to 1,500 necessary to support an accredited high school, good stores, markets, financial facilities, efficient professional service, and strong churches, the many small towns must accept

a neighborhood status, and adjustments of farm and town population must be made on a new and more effective basis of a larger population, greater resources, mutuality of control and direction of institutions, and genuine cooperation of town and country people.

Comparison of rural and urban churches.—Thirty per cent of the rural and 44 per cent of the urban population of the State were found to be church members. For rural and urban Michigan there were, respectively, the following: Population per church 400 and 1,340, number of members per church 119 and 610, Sunday school enrollment per church 82 and 237, and membership under 13 years of age 21.4 and 23.4 per cent.

The sociology of a village and the surrounding territory, B. L. Melvin (*New York Cornell Sta. Bul. 523 (1931), pp. 138, figs. 25*).—This investigation, which is an experiment in making a thorough sociological study, deals with an area of approximately 100 square miles in Cortland and Broome Counties. The area is a dairy section with a village of 955 population (census of 1925), an unincorporated village, and four hamlets. Data were obtained by visits to all the families within the area, comprising 273 in the village of Marathon, 47 in the unincorporated village of Killawog, and 358 in the open country including the hamlets. Special blanks were used to record data regarding each business agency, organization, and institution. Facts dealing with the development of the area were obtained by consulting publications and records and by interviews with residents of the area.

The data as they pertain to the structure, relationships, activities, and problems of the region are analyzed and discussed under the heads of communication; the population; the family and the home; economic organization, relationships, and problems; professions; the educational situation; religious organizations and activities; and special groups and activities. The population changes; the evolution in means of communication and of business and the professions, industries, agricultural production, and educational and religious institutions, organizations, and activities; the changes in social and recreational activities; and public enterprises from the settlement of the area to 1930 are described and discussed.

The implications and practical considerations of the study and the synchronization of the events shown by the analysis are included in a discussion of the influence of contacts, social organization of a rural area, the breaking-down of neighborhoods, community organization, extension work for colleges of agriculture in rural sociology, and parallelisms in social change.

The study indicates that the rural territory studied is taking on urban characteristics, and that the present social evolution is away from its formation as a rural community and toward the formation of special-interest and activity groups. Locality groupings were found to have disintegrated, the breaking down of neighborhoods having apparently begun with the coming of the rural mail routes. Reorganization of rural life when concerned with the formation of voluntary groups, the author concludes, must be made on the basis of special activities and interests, although there is a definite need for an organization the function of which would be the promotion of the public good. Such an organization, however, the author feels, must be a body with a definite purpose rather than merely one for promoting general community organization. The adoption of city methods by both individuals and groups is deemed essential for success in their work and activities. At the present stage of the development of rural sociology the author is inclined to believe that the rural sociologists sent into rural localities by the colleges of agriculture should be research specialists to discover what the prevailing

needs are, and experts in organizing and handling groups to help remedy prevalent difficulties arising in the process of social change, rather than subject-matter specialists similar to those in agronomy, plant pathology, etc.

The communities of Schuyler County, New York, 1927, R. E. WAKELEY (*New York Cornell Sta. Bul. 524* (*1931*), *pp. 74, figs. 28*).—This is a study of a typical rural area in the hilly plateau region of southern New York, with chief consideration given to the number, location, and size of centers, the number and grouping of organizations and service agencies, the patronage area for each service agency or the membership area for each organization, the number of members in each organization, and the community activities promoted by the organizations. The data were obtained by personal interviews with the leaders and representatives of each organization and agency in the county, except in the case of the two larger centers, in which only the economic agencies rendering services directly to farmers were visited.

The agriculture, farms and farm land, marginal and submarginal areas, the early development and organization, the characteristics of the population, and the communication and transportation services of the county are described. Tables are given and discussed showing the population, number, and types of organization in the service centers, which consisted of a town of 2,919 people in 1925, 3 incorporated villages, 14 unincorporated villages, and 5 hamlets. The areas served by different economic, educational, religious, social, and health agencies or organizations are discussed and maps included for the more important ones. The membership and community activities of organizations are analyzed by class of service and place of residence. The types of services—primary, communication, secondary, and specialized—rendered by neighborhood, primary, semicomplete, and complete community centers in the county, and the community and other activities during the year ended June 30, 1927, are discussed.

Some of the facts shown or indicated by the study were as follows: While the population of incorporated places has remained practically stationary since 1900, that of the unincorporated villages has decreased 27.3 per cent and that of the hamlets 45.8 per cent from 1874 to 1927. High schools and hardware and cash grocery stores were found to be centering in incorporated places, in centers where the schools offered courses in agriculture and home economics. The services of the smaller places have been increased through the tendency of farm bureau, home bureau, and 4-H Club units to organize in small unincorporated places. Residents of predominantly submarginal farming areas seemed unable to maintain any kind of formal social organization. By using some definite service as a basis, the economic service areas of the county were easily located. The unincorporated village was the principal center and the rural church the agency furnishing the most organized contact. The concept of self-sufficiency seemed valueless in describing the community relationships in the county. The communities were mostly quite unorganized, and there appeared to be little need for more formal organization. It was clear, however, that the concept of community organization may well be broadened to include all organizations and all types of communities. Closer functional relationships are highly desirable between all types of communities and may be more easily developed if there is a sense of solidarity in the locality groups.

Rural standards of living: A selected bibliography, compiled by L. O. BERCAW (*U. S. Dept. Agr., Misc. Pub. 116* (*1931*), *pp. 84*).—This bibliography has been previously noted in mimeographed form (E. S. R., 63, p. 889).

FOODS—HUMAN NUTRITION

Vegetable cookery at high altitudes, E. J. Thiessen (*Wyoming Sta. Bul. 180 (1931), pp. 32, figs. 3*).—The data reported in this publication include time-tables for boiling, steaming, and baking various vegetables in portions yielding four servings, or two cups when cooked, at Laramie at an altitude of 7,159 ft., and a comparison of these time-tables with similar ones reported by Halliday and Noble for the lower altitude (600 ft.) of Chicago.

A comparison of the time required for boiling the same kinds of vegetables in 1929–30 and in 1930–31 showed that in boiling shredded cabbage (white and green), turnips cut in ¾ in. cubes, cauliflower separated into flowerets, and sliced carrots the variations in time required to reach the same stage of tenderness did not exceed 5 minutes. It was concluded that for these vegetables standard time-tables might safely be used provided standard methods were followed. For rutabagas, Irish potatoes, parsnips, old carrots, and beets the range in time was so great that an exact time-table could not be stated. Baking tests for Irish potatoes, sweetpotatoes, and squash showed little variation if uniform sizes were used. The range of time for steaming in the pressure cooker was small.

The chief variations between the low and the high altitude time-tables occurred in boiling vegetables. Beets, cauliflower, and onions required the greatest increase in time at the high altitude (55 to 66 per cent), followed by green cabbage, Irish potatoes, parsnips, rutabagas, squash, sweetpotatoes, and turnips (20 to 25 per cent), and old carrots (11 to 14 per cent). Vegetables steamed in the pressure cooker required the same length of time at the high altitude as at the low provided the pressure was 3 lbs. greater. Irish potatoes and carrots required a longer time for steaming at the high than at the low altitude, but sweetpotatoes and squash required no longer time. Baking appeared to require no longer time at the high than at the low altitude.

The publication includes a discussion of the effect of cooking on the color and flavor of vegetables, the effect of storage upon the quality of vegetables when cooked, and the percentage of waste in ordinary paring of vegetables.

Baking of pears, A. Kolshorn (*Oregon Sta. Bul. 283 (1931), pp. 20, figs. 5*).—Suggestions based upon a series of baking tests under controlled conditions are given for baking Bosc, Comice, and D'Anjou pears. The products were judged on score cards for appearance and tenderness of skin, color, shape, texture, and flavor of the fruit, and consistency, color, and flavor of the juice. On the basis of the scores obtained a standard recipe for whole baked pears was recommended as follows:

Select firm, well-ripened pears of uniform size and shape and place upright in deep baking dish. For 4 pears use ⅓ cup of sugar and ½ cup of water. mix sugar, water, and seasonings, and pour the mixture over the pears, cover and bake at 300° F. for from 2 to 2.5 hours or 400° for from 1 to 1.5 hours. The seasonings recommended, either alone or in various combinations, in amounts sufficient for 4 pears are from 2 to 4 teaspoonfuls of lemon juice, ¼ to ½ teaspoonful of lemon rind, 1 teaspoonful of chopped ginger, ¼ teaspoonful of ground ginger, 1 piece of stick cinnamon 2 in. long, and ½ tablespoonful of butter.

Mineral analyses by D. E. Bullis of the three varieties of pears are included. Of the more important elements, the values reported for calcium (presumably in percentage of fresh material) were 0.0126 for the D'Anjou, 0.0147 for the Bosc, and 0.0129 per cent for the Comice variety. Corresponding values for phosphorus were 0.0156, 0.0165, and 0.0117 per cent, respectively, and for iron

0.000139, 0.000117, and 0.000148 per cent, respectively. The values given for the alkalinity of the ash were D'Anjou 4.53, Bosc 3.8, and Comice 3.83.

Avocado preservation and utilization (*Hawaii Sta. Rpt. 1930, pp. 19–22*).—This progress report summarizes studies by E. V. Harrold of various methods of preserving and utilizing avocados. The quinine-like bitter principle that forms in the avocado when heated proved a decided handicap in efforts to preserve the fruit by processing. Treatment with weak acids such as citric, tartaric, and acetic acid appeared to increase the amount of the bitter principle, which was destroyed, however, by the addition of from 1 to 2 per cent of hydrochloric acid or by slow or quick freezing.

Most of the methods of treating avocados which were tested proved unsatisfactory on account of the development of bitterness or loss of the particular flavor or undesirable changes in color or texture. Although ordinary canning methods proved unsatisfactory, it was found that when avocado cubes, halves, or slices were soaked in pineapple vinegar until penetrated by the liquid and then removed from the vinegar and processed at 212° F. for at least 10 minutes, or 160° for 20 minutes, the natural color destroyed by the soaking process was restored. For satisfactory results, the vinegar should have an acidity of at least 6 per cent. A satisfactory product was obtained by combining the avocados thus treated with an equal amount of canned crushed pineapple to which fruit spices siruped with a 50 per cent sugar solution had been added. The combination should be exhausted for 10 minutes and processed for 30 minutes at 160°.

Cold storage tests indicated that Hawaiian-grown avocados may be stored green at 36° for from 6 to 8 weeks, and that after this storage the fruit ripens satisfactorily within 2 to 5 days. Avocado cubes and halves stored at temperatures from 0 to 20° in diluted brines, vinegar, sirups, and water in paraffined cartons, glass, and tin cans tightly sealed to prevent oxidation did not retain their original texture on thawing, but were of satisfactory color and made good sirups.

A satisfactory avocado pulp for use in ice cream was made by mixing 1 part of sugar with 5 parts of pulp and storing the mixture in sealed containers at 0°. The pulp when mixed with a small amount of vinegar was also satisfactory for use in salads, relishes, and sandwiches.

The "frozen-pack" method of preserving berries, E. H. Wiegand (*Oregon Sta. Bul. 278 (1931), pp. 42, figs. 11*).—This publication reports the results of studies conducted in 1928, 1929, and 1930 in the hope of reducing or eliminating spoilage in frozen fruits in small containers. The commercial methods employed in the State at the time are outlined, the different methods tested in the present investigation summarized, and the results obtained discussed, with recommendations for future practice. These recommendations include prompt handling of the fruit, the use of vacuum-closed containers, varieties of berries best adapted to freezing, the type of sugar giving the best results and densities of the sirup for different berries, and the use of precooling and cold storage of the berries before freezing and of low freezing temperatures.

[Fruit products] (*California Sta. Rpt. 1930, pp. 104, 105*).—Measurements by M. A. Joslyn, in cooperation with G. L. Marsh, of the temperature changes occurring during the freezing and thawing of frozen pack fruits and vegetables have shown that the heat transfer takes place chiefly by conduction rather than by convection and consequently is relatively slow. Among the more important factors affecting the rate of freezing and thawing are the size, composition, and shape of the container, the conductivity of the product, and the temperature of the surrounding space. Heat transfer is more rapid in sirups of high than in those of low density.

With suitable methods of freezing storage, persimmons and avocado pulp were preserved with practically no change in flavor. Peeled and sliced apples dipped in dilute sulfurous acid retained their color and were satisfactory for pie making. The pectin content of berries was not noticeably changed. Peas, string beans, and green asparagus retained their fresh quality. A short blanching in boiling water was found to improve the keeping quality of vegetables in freezing storage. "Observations on the spoilage of nonacid fruits and vegetables after thawing showed the possibility of growth of *Clostridium botulinum* on prolonged standing at room temperature, and emphasized the necessity of great care in distributing frozen foods."

The thirty-fifth report on food products and the twenty-third report on drug products, 1930, E. M. Bailey et al. (*Connecticut State Sta. Bul. 329 (1931), pp. 609–668*).—Included among the routine analyses of foods and drugs submitted in this annual report (E. S. R., 63, p. 788) are analyses of 34 samples of commercial mayonnaise salad dressing, 24 of miscellaneous and special foods, and 11 of potatoes. A comparison by C. E. Shepard and Bailey of the Reinsch, Gutzeit, Ramberg, and modified Marsh tests for arsenic in animal tissues is appended.

The effect of heat upon the biological value of cereal proteins and casein, A. F. Morgan (*Jour. Biol. Chem., 90 (1931), No. 3, pp. 771–792*).—In this investigation, in which the author had the cooperation of F. B. King, R. E. Boyden, and V. A. Petro, the effect of heat on cereal proteins was first tested by growth experiments conducted on young rats, using raw, water-cooked, and toasted wheat, rice, and corn, alone or supplemented by small amounts of casein, as the chief constituent of the diet. The diet consisted of cereal 95 (or cereal 90 and casein 5), agar 2, and Osborne and Mendel salt mixture 3 per cent, together with 0.5 gm. of dry brewery yeast and 25 mg. of cod-liver oil per rat per day. The experiments were continued for 8 weeks, with careful records of food intake and Kjeldahl nitrogen determinations for each diet. The values of the different proteins for growth were calculated in gains per gram of protein consumed according to the method of Osborne, Mendel, and Ferry (E. S. R., 40, p. 765).

In all cases the growth as thus determined was least on the toasted product and greatest on the raw. Raw cracked wheat produced a gain of 1.68 and toasted cracked wheat 1.12 gm. per gram of protein, white bread 1.5 and toasted white bread 1.02, raw rice 1.41 and puffed rice 0.55, and raw yellow corn 1.2 and toasted corn 0.82 gm. per gram of protein. The addition of 5 per cent of casein to the toasted materials very nearly made up the discrepancy between the raw and toasted food, thus indicating that the deficiency was in the protein fraction.

The investigation was continued by feeding raw and toasted wheat gluten as the source of protein at 9, 12, 15, 18, 21, and 24 per cent levels (crude protein) in a diet otherwise adequate. In this series the gains per gram of protein in the 8 weeks' period varied from 1.29 to 1.4 for the raw gluten at all levels up to 18 per cent and then fell to 1.15 and 0.98 at 21 and 24 per cent. In all cases the gains on the toasted wheat gluten were less, the corresponding levels being 0.94 to 1.09, 1.12 and 0.86. The maximum growth rate on both the raw and toasted diets took place at the 18 per cent level.

The biological values of raw, water-cooked, and toasted whole wheat gluten alone and supplemented by 5 per cent casein were then determined according to the method of Mitchell (E. S. R., 51, p. 407), first using carefully matched pairs of rats and later single mature rats for the toasted and raw proteins in succession. The biological values as thus determined were 64 and 67 for raw cracked wheat alone and supplemented with casein, respectively, 67 and 75 for

water-cooked cracked wheat alone and with casein, 52 and 69 for toasted wheat alone and with casein, and 66 and 54 for raw wheat gluten and toasted wheat gluten. In these experiments the protein was fed at levels of from 9 to 14 per cent. When large mature rats were used in a similar study of raw and toasted wheat gluten at levels of 6 and 8 per cent, the values obtained were 83 and 64 and 66 and 53 per cent, respectively.

In these experiments the digestibility of the toasted proteins as measured by percentages absorbed were practically the same for the raw and toasted proteins. This is thought to indicate that "the change produced by the heat treatment lies probably in the assortment or availability of the amino acids absorbed."

The effect of different per cents of protein in the diet, I–IV, J. R. Slonaker (*Amer. Jour. Physiol., 96 (1931), No. 3, pp. 547–556, figs. 2, pp. 557–561; 97 (1931), Nos. 1, pp. 15–21; 2, pp. 322–328*).—These four papers form a part of an extensive investigation undertaken to determine by observations through several generations the percentage of protein in the diet best adapted to bring about maximum results in the physiological functions of the rat in the hope of establishing certain physiological principles applicable to other animals, including man.

I. *Growth*.—This paper describes the general plan of the investigation, with the experimental diets used, and reports data on the growth of the original pairs of rats and such replacements as were made on account of the early deaths of some of the original animals.

The diet containing the lowest percentage of protein consisted of cornstarch 5,000, whole ground wheat 2,000, whole ground yellow corn 1,000, commercial skim milk powder 400, ground alfalfa leaves 400, commercial casein 200, meat scrap 100, wheat germ 300, unsalted butter 500, yeast 200, sodium chloride 100, and calcium carbonate 150 gm. These were thoroughly mixed and run through a grinder. This mixture was designated as diet I and used as the basis for four other diets containing increasing amounts of meat scrap as additional sources of protein. The proximate composition of diet I was protein 10.3, fat 12.2, and carbohydrate 77.5 per cent. Corresponding values for the other diets were II 14.2, 14.2, and 71.6; III 18.2, 15.9, and 65.9; IV 22.2, 17.8, and 60; and V 26.3, 19.7, and 54 per cent, respectively. Each of the five diets had an energy value of 3.82 calories per gram.

The experiment was started with 90 pairs of rats, 18 for each group. With the exception of the first group, the average age of which at the beginning of the experiment was 44 days, the animals were started on the experiment at approximately weaning time, from 23 to 29 days of age. In order to determine the daily spontaneous activity and food consumption, 10 females of each group were kept in individual revolving cages and removed from the cages only for weighing and mating. The others were kept by pairs in separate cages. The paired animals were weighed monthly and the young daily until weaned and then every 3 or 4 days until about 50 days of age and after that monthly.

The order of maximal weights by groups from highest to lowest was II, III, I, IV, and V. The order of weight at death from highest to lowest was II, V, IV, I, and III for the males and III, II, IV, V, and I for the females. Disregarding 4 of the females having large tumors, II and III were reversed. The order of length of life was II, III, I, IV, and V for the males and II, III, IV, I, and V for the females. The average life span for all males was 691 days and females 785 days.

"These results indicate that when best growth is considered the amount of protein in the diet should be slightly in excess of 14 per cent. A deviation

of 4 per cent less or greater produced no serious results. They further show that as the percentages of protein increased beyond the optimum there was a progressive retardation in growth. Indications are that similar results would obtain if the percentage of protein were reduced progressively below the optimum."

II. *Spontaneous activity.*—Data on the spontaneous activity of the five groups of female rats kept in revolving cages are reported with the following general results: The number of days intervening from the time the rats were placed in revolving cages until spontaneous running began increased with the protein content of the diet. The order of magnitude of activity of the different groups during the first few weeks decreasd in the order III, II, I, V, and IV. Making allowance for activity loss incident to reproduction, the order became II, III, I, IV, and V. It is concluded that a diet containing between 14 and 18 per cent protein is the most favorable for maximal spontaneous running.

III. *Intake and expenditure of energy.*—The data summarized in this paper were likewise obtained on the groups of female rats serving as subjects in the previous study.

Up to approximately 150 days of age the average daily food consumption from greatest to least was in the order groups I, II, III, IV, and V. The greater consumption in group I is attributed to the greater age and weight of the animals of this group at the beginning of the experiment. During the first 120 days the average percentage increase in body weight from greatest to least was in the order of groups V, IV, III, II, and I; the spontaneous running activity III, I, IV, II, and V; and the energy available for growth and basal metabolism I, II, III, IV, and V. For the whole life span the average daily feed intake in grams in decreasing order was group III 20.11, V 19.94, I 18.36, II 17.92, and IV 16 gm.

The average life span from longest to shortest was in the order II, III, V, IV and I; the order of number of young born and number of young nursed and weaned II, III, I, IV, and V; and the order of average maximal weight III, II, I, V, and IV. These results are thought to indicate that a diet containing between 14 and 18 per cent protein is the most efficient for maximal growth, spontaneous activity, reproduction, and life span.

IV. *Reproduction.*—The reproduction data summarized in this paper were obtained on the 18 original pairs of rats in each group, with such rematings as were necessary on account of the death of original animals.

In the first matings the mortality of the males was in general greater than of the females. For both sexes mortality was least in groups II and III and highest in group V.

Sterility was more pronounced in the males than in the females in each group. The order of fertility in both sexes from the highest to lowest was group II, I, III, IV, and V. In group II the percentage fertility of the males was 87 and the females 100. The corresponding values for group V were 33 and 50 per cent, respectively.

The reproductive spans for both sexes in decreasing order were II, I, III, IV, and V. The same order held for the average number of litters and the average number of young born per pair. In size of litter the first two groups were reversed. Other respects in which group II excelled the other groups were in sex ratio of the young and percentage of the young weaned.

Further studies on the basal metabolism of Maya Indians in Yucatan, G. C. SHATTUCK and F. G. BENEDICT (*Amer. Jour. Physiol., 96 (1931), No. 3, pp. 518–528*).—The observations reported supplement the earlier measurements on Mayas reported by Williams and Benedict (E. S. R., 60, p. 391). The present

series of measurements was made on 26 male subjects, 9 of whom were among the subjects of the earlier study.

The data confirm the earlier findings of a high basal metabolism associated with low heart rate and low blood pressure. The average in the present series was 5.8 per cent above the Harris-Benedict predictions. In the instances in which observations were repeated on the same subjects there was a tendency for the metabolism to be slightly lower in the second measurements. Some of the difficulties involved in conducting metabolism experiments on these uneducated natives are discussed. The possibility is suggested that by repeated observations metabolism figures might be reached that could not be considered abnormally high. "This suggestion must not be lost sight of, although our evidence in general is that these people are quiet, phlegmatic, and nontemperamental. Indeed, there was no indication, so far as the pulse rate is concerned, of psychic disturbance."

The determination of the total heat eliminated by the human being, M. W. Johnston and L. H. Newburgh (*Jour. Clin. Invest., 8 (1930), No. 2, pp. 147–160, fig. 1*).—The assertion of Benedict and Root, confirmed by Levine and Marples for infants (E. S. R., 63, p. 894), that the basal metabolic rate may be accurately predicted from the basal insensible loss of weight has been confirmed for adults, and the method has been extended to measure the total 24-hour heat production of human subjects. In the use of the method it is necessary to guard against two major sources of error, sweating and cooling of the skin below the critical temperature. A series of observations is reported demonstrating the applicability of the method.

Measurement of total water exchange, L. H. Newburgh, M. W. Johnston, and M. Falcon-Lesses (*Jour. Clin. Invest., 8 (1930), No. 2, pp. 161–196, figs. 2*).—Attention is called to the fact that the terms "water balance" or "water exchange" are commonly understood to mean the comparison between the water entering the body as food and drink and that leaving it as urine, whereas in reality such a comparison fails to take into account "(1) the large amount of water that is evaporated from the skin and lungs; (2) the water that is formed by oxidation of the food; (3) water physically held as part of the protoplasm, but set free when the organism derives some of its energy by burning its own tissues."

With this in mind, a system has been developed for obtaining an accurate account of all the sources and total amount of water that becomes available to the organism on the one hand and the amount that leaves it on the other hand. The system is described in detail, with data showing its application.

The effects of deficient water-intake on the growth of the rat, C. M. Jackson and V. D. E. Smith (*Amer. Jour. Physiol., 97 (1931), No. 1, pp. 146–153, figs. 2*).—In this study, which continued for several months, 2 rats were used as normal controls with unrestricted food and water; 7, designated as test rats, were given food ad libitum with only enough water to hold the body weight as nearly constant as possible; and 3, designated as restricted food controls, were given the same amount of food as that voluntarily consumed on the preceding day by a corresponding rat in the test group, but with water ad libitum.

The test rats showed a progressively decreasing requirement for water up to the second or third month, after which there was a slight increase. The food consumption was roughly proportional to the water intake. Although remaining active and in apparent good health, the animals became emaciated and their organs on autopsy showed dehydration. The restricted food controls receiving water ad libitum also became emaciated, but made remarkable gains

in body weight, ranging from 33 to 98 per cent. Their organs showed slight dehydration, but not nearly as marked as those of the test rats.

This comparison is thought to demonstrate the importance of water intake on growth independent of food consumption.

The nature of obesity, L. H. NEWBURGH and M. W. JOHNSTON (*Jour. Clin. Invest., 8 (1930), No. 2, pp. 197–213, figs. 6*).—Essentially noted from another source (E. S. R., 63, p. 491).

The vitamin A, B, and D content of canned vegetables (*Michigan Sta. Bien. Rpt. 1929–30, pp. 36, 37*).—This progress report summarizes briefly studies which have been conducted for three successive seasons on the content of vitamins A and B (undifferentiated) in raw peas of the Rice No. 13 variety grown on the same garden plat in the successive years, and of the effect of commercial canning methods on the content of these vitamins. A report covering the first year's results has been noted previously (E. S. R., 61, p. 793).

The results over the 3-year period showed a marked seasonal variation in the vitamin A content. The 1927 crop was lowest and the 1929 crop highest in this vitamin. About six times as much of the peas were required in 1927 and twice as much in 1928 as in 1929 to produce the same gains in weight in the experimental rats. Corresponding differences were also evident in the canned peas. In all cases peas canned by blanching for 5 minutes and processing for 40 minutes at 15 lbs. pressure were approximately equal in vitamin A content to raw and freshly cooked peas.

No seasonal variation was shown in the content of vitamin B. Attempts to lessen the destruction of this complex in canning by decreasing the time of processing or blanching were unsuccessful. With any of the methods used the loss amounted to from 30 to 45 per cent.

Preliminary tests on canned corn showed that commercially canned Golden Bantam corn had a high content of vitamin A, although a little lower than peas, and that commercially canned white Country Gentleman corn contained not more than a trace of vitamin A. Both varieties contained small amounts of vitamin B (undifferentiated), the yellow corn being about one-fourth richer than the white corn.

Preliminary tests on commercially canned red cherries gave inconclusive results on account of the difficulty in getting the rats to eat the cherries.

Vitamin C content of oranges and tomatoes, C. D. MILLER (*Hawaii Sta. Rpt. 1930, p. 23*).—Preliminary studies indicate that the vitamin C content of Hawaiian-grown oranges is equal to that of the California-grown fruit, and that Hawaiian-grown tomatoes are richer in vitamin C than similar tomatoes grown on the mainland. "The superiority of the Hawaiian-grown fruit is probably due to the fact that it is picked when fully ripe, whereas tomatoes from the coast region of the mainland must be picked when green for shipping to Hawaii."

The effect of the use of mineral oil upon the absorption of vitamin A, J. I. ROWNTREE (*Jour. Nutrition, 3 (1931), No. 4, pp. 345–351*).—To test the effect of mineral oil upon the absorption and utilization of vitamin A, rats suffering from vitamin A deficiency were given doses of mineral oil considered to be comparable to the human therapeutic dosage, together with varying amounts of cod-liver oil. When the quantity of cod-liver oil furnished only enough vitamin A to produce subnormal growth, the rats were unable to respond, but when considerably larger amounts were given cures were effected and growth resumed. The author suggests that if mineral oil is employed as a laxative it should be accompanied by a generous amount of fat-soluble vitamins.

The specific effect of vitamin B on lactation, growth, and water metabolism, B. SURE, M. C. KIK, M. E. SMITH, and D. J. WALKER (*Science, 73 (1931), No. 1889, p. 285*).—It is noted briefly, without experimental data, that vitamin B

exerted a specific beneficial influence on lactation apart from its effect upon food intake. This was demonstrated by restricting lactating rats on a vitamin B-deficient ration plus supplements of vitamin B to the same daily intake of food and water as litter mates on the unsupplemented vitamin B-deficient ration. Under these conditions the effect of vitamin B on the reduction of infant mortality and on the growth of nursing young was very pronounced. It is also noted that vitamin B has been found to exert a specific influence on growth, and that there is a definite relationship between water and food intake in this deficiency disease. "An excess of the proportionate amount of water to the reduced food intake, after this deficiency disease has progressed to the more accentuated stages, is detrimental to the organism."

Diet and tissue growth.—VIII, Influence of vitamins B, G, and undifferentiated B on the effects produced by protein-rich diets upon the kidney of the rat, L. D. FRANCIS, A. H. SMITH, and T. S. MOISE (*Amer. Jour. Physiol., 97 (1931), No. 1, pp. 210–214*).—Essentially noted from a preliminary report (E. S. R., 62, p. 493).

Effect of the antirachitic factor and ultra-violet irradiation on calcium metabolism of women (*Michigan Sta. Bien. Rpt. 1929–30, pp. 37, 38*).—To determine the effect of cod-liver oil or ultra-violet irradiation on the calcium and phosphorus metabolism of adult women, several women were given a diet adequate in calories and protein, but low enough in calcium and phosphorus to give slightly negative balances. After the balances had been determined on this diet, the subjects took cod-liver oil for 38 days and the balances were again determined. Several months later the same subjects were irradiated with a quartz mercury vapor lamp 5 days a week for 11 weeks previous to, as well as during, the balanced period.

Considerable variations were shown in calcium excretion, although the intake was constant. Neither irradiation nor cod-liver oil caused a marked retention of calcium. On the theory that this might have been due to the very small amount of calcium ingested, 0.274 gm. daily, the experiment with cod-liver oil was repeated, with a calcium intake of 0.358 gm. daily. This resulted in a slightly better retention after the administration of cod-liver oil.

The elimination of phosphorus was more nearly constant than of calcium. In the first group of experiments cod-liver oil seemed to cause a slight and ultra-violet irradiation a more marked increase in retention. In the second experiment, in which the calcium was increased and the phosphorus remained the same, the ingestion of cod-liver oil resulted in an increase in phosphorus retention.

The induction of tetany in rachitic rats by means of a normal diet, A. F. HESS, M. WEINSTOCK, H. R. BENJAMIN, and J. GROSS (*Jour. Biol. Chem., 90 (1931), No. 3, pp. 737–746*).—Essentially noted from another source (E. S. R., 64, p. 597).

A new pathological condition of probable dietetic origin in rats, C. FUNK and S. and H. CASPE (*Soc. Expt. Biol. and Med. Proc., 28 (1931), No. 8, pp. 816–818, fig. 1*).—The condition described and illustrated is a peculiar segmentation of the tail which has been observed by the authors in rats within 8 or 10 days after having been placed on a diet of 18 per cent casein (A- and B-free, British Drug Houses), 78 per cent cornstarch, and 4 per cent McCollum's salt mixture. "These symptoms start with a slight segmentation of the distal end of the tail, followed by a more accentuated constriction, reddening of the segment, sometimes bleeding, necrosis, and falling off of the tail tip. As the experiment proceeds the segmentation and the process extend."

The condition is thought to be distinct from that described by Burr and Burr (E. S. R., 63, p. 595) in that it develops earlier and is not prevented

by a daily addition of 400 mg. of lard, 2 drops of cod-liver oil, or 2 drops of linoleic acid. The symptoms were not delayed by replacing the purified casein by ordinary commercial casein, nor did 50 mg. of dried yeast prevent their appearance. Arrest in growth usually coincides with the development of severe lesions.

TEXTILES AND CLOTHING

[Wool studies in California] (*California Sta. Rpt. 1930, p. 56*).—Fleeces grown for 6 months on a fattening ration were compared with those from the same animals, 3 Romney wethers, grown for an equal period one year later on a submaintenance diet. The fattening ration produced 343 per cent greater grease weight of wool, 320 per cent greater scoured weight, 172 per cent greater length of staple, and 250 per cent greater strength of fiber. A combing test in cooperation with the Lowell Textile Institute showed that the fleeces grown on the fattening ration produced an average of 2.97 noils and those from the deficient diet 6.94 per cent.

Medullated wool fibers (E. S. R., 61, p. 698) appeared to differ from the nonmedullated fibers of the same fleeces in their affinity for both acid and mordant dyes. There was evidence that not all portions of single fleeces have the same affinity for dyestuffs.

HOME MANAGEMENT AND EQUIPMENT

The family finances of 195 farm families in Tompkins County, New York, 1927–28, H. CANON (*New York Cornell Sta. Bul. 522 (1931), pp. 84, figs. 4*).—Farm homes in Dryden and Lansing Townships, Tompkins County, were selected for this survey (covering a period from April 1, 1927, to March 31, 1928) on account of the fact that farm management records for these farms were available from a survey conducted by the department of agricultural economics and farm management of the State college of agriculture. The farms in the region selected were fairly representatitve of many of the farming regions of the State.

Of the 195 families from whom sufficiently complete records were obtained, there were only 29 tenants and about one-third of these had practically the same interests as owners. Consequently no distinction was made between owners and tenants. The immediate family was defined as including parents and children who were wholly or partly dependent on the family income for support whether living at home or away from home. More than half of the farm operators were between 40 and 60 years of age. Families consisting of 2 or 3 persons and in which the operator and home maker were past middle age were most common.

In addition to the records of cash farm receipts obtained from the farm management study, records were obtained of receipts from practically all other sources. The various sources of cash receipts, with their relative importance in terms of percentage of total cash receipts, were farm business 88, wages off farm 3, boarders and lodgers and borrowings 2 each, and rent not connected with farm, interest and dividends, withdrawals from savings bank, inheritance, and other income 1 per cent each. The average cash receipts per family amounted to $2,296 and the average number dependent upon the income was 3.6. More than half of the families had receipts under $2,250 and over one-fourth between $750 and $1,500.

The total cash expenses for all purposes were under $2,000 for half of the families and under $3,000 for three-fourths of the families. The average cash expenditure per family was $2,223.

A total of 84 families reported indebtedness amounting to an average of $2,104 per family. The indebtedness per family reporting debts was greater for the families with high cash receipts than for those with low receipts, but there was no striking difference between the two groups in the ratio of indebtedness to capital. Families reporting investments numbered 122, with an average of $310 per family. The investments were largely in the form of deposits in savings banks and payments on mortgages.

The distribution of total cash expenses was for farm business 50, household expenses 38, investments 9, and all other purposes 3 per cent. Although the cash receipts of the families with the highest receipts were 11 times those of the families with the lowest receipts, the farm expenses were only about 7 times as high, household expenses about 3, investments 14, and all other expenses 6 times as high.

For nearly three-fourths of the families the household expenses were under $1,000 and for half the families between $500 and $1,000. The average expenditure per family was $831, distributed as follows: Food $260, clothing $163, housing $53, furnishings and equipment $41, other housekeeping expenses $107, health $44, transportation $66, personal expenses $24, miscellaneous $65, and other expenses $8. The factors influencing the expenditures for each of these items are discussed in considerable detail.

The average value of the farm homes was $1,612, the value increasing with the cash receipts. Of the operator's total capital, 19 per cent was in the house. Most of the houses were old and for about one-fourth of the families apparently not of the desired size. Of all the homes, 70 per cent obtained water for kitchen use from a pump or spring, 16 per cent were equipped with running cold water, and 14 per cent with running hot and cold water. Only 24 per cent of the homes had indoor toilets, and as many as 82 per cent used kerosene for lighting. Nearly every family owned a sewing machine, 75 per cent a washing machine of some kind, 37 per cent vacuum cleaners, and 21 per cent refrigerators.

The average number of hours of work per day of the home maker approximated 12 and the hours of free time 2. The amount of time devoted to farm work averaged 1.5 hours a day and decreased somewhat with increasing receipts.

About one-fifth of the families did not patronize chain stores at all for their food purchases, about two-fifths did all of their buying at chain stores, and most of the remaining families patronized the chain stores for half or more of their buying.

Life insurance was carried by 41 per cent of the families, the average amount carried being $1,952.

MISCELLANEOUS

Report on the agricultural experiment stations, 1930, W. H. Beal, H. M. Steece, et al. (*U. S. Dept. Agr., Off. Expt. Stas., Rpt. Agr. Expt. Stas., 1930, pp. 100*).—This report is discussed editorially on page 702.

Report of the [California] Agricultural Experiment Station, [1930], C. B. Hutchison (*California Sta. Rpt. 1930, pp. [1]+114, pl. 1, figs. 2*).—This contains the organization list, a report of the director and summary of the work of the station for the year ended June 30, 1930, including data as to projects and publications, and a summary, by B. H. Crocheron, of the work of the agricultural extension service (pp. 108–114). The experimental work reported not previously noted is for the most part abstracted elsewhere in this issue.

Report of the director [of Connecticut Storrs Station], 1930, W. L. SLATE (*Connecticut Storrs Sta. Bul. 171 (1931), pp. 33, figs. 12*).—This contains the organization list, a report of the director, and a financial statement for the fiscal year ended June 30, 1930. The experimental work reported is for the most part abstracted elsewhere in this issue.

Report of the Hawaii Agricultural Experiment Station, 1930, J. M. WESTGATE ET AL. (*Hawaii Sta. Rpt. 1930, pp. [2]+38, figs. 16*).—This contains the organization list, the memorandum of understanding between the U. S. Department of Agriculture and the University of Hawaii for the consolidation of station work in Hawaii, a summary of investigations by the director, and departmental and substation reports. The experimental work reported not previously noted is for the most part abstracted elsewhere in this issue.

Abstracts of papers not included in bulletins, finances, meteorology, index (*Maine Sta. Bul. 357 (1930), pp. 233–255+XIII*).—This contains the organization list of the station; abstracts of 7 papers, 4 of which are noted elsewhere in this issue, 2 previously (E. S. R., 63, p. 754; 64, p. 193), while the seventh (p. 233), by J. H. Hawkins, deals with Tarsal Claws of Noctuid Larvae; meteorological observations; a financial statement for the fiscal year ended June 30, 1930; an index to Bulletins 354 to 357, inclusive, which collectively constitute the forty-sixth annual report of the station; an index to the reports for the years 1926 to 1930 and to Bulletins 329 to 357, inclusive; and announcements as to the work and publications of the station.

Biennial Report [of] Michigan Agricultural Experiment Station for the two years ended June 30, 1930, V. R. GARDNER (*Michigan Sta. Bien. Rpt. 1929–30, pp. 60*).—This contains a report of the activities of the station, a list of its publications, and a financial statement for the fiscal years ended June 30, 1929 and 1930. The experimental work reported not previously noted is for the most part abstracted in this issue.

Annual Report of [Nevada Station], 1930, [S. B. DOTEN] (*Nevada Sta. Rpt. 1930, pp. 29, figs. 2*).—This contains the organization list, a financial statement for the Federal funds for the fiscal year ended June 30, 1930, lists of station projects and publications, and a report of the director discussing the work and problems of the station during the year. The experimental work reported is for the most part abstracted elsewhere in this issue.

Report of the Virgin Islands Agricultural Experiment Station, 1930, J. B. THOMPSON ET AL. (*Virgin Islands Sta. Rpt. 1930, pp. [2]+19, figs. 11*).—This includes the organization list and reports by the director, the animal husbandman and veterinarian, the horticulturist, the agronomist and the agriculturist for St. Thomas and St. John as to the work of the station for the fiscal year ended June 30, 1930. The experimental work reported is for the most part abstracted elsewhere in this issue, as are also meteorological observations.

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NOTES

Arizona University and Station.—Dr. E. D. Ball, dean of the College of Agriculture and director of the station, resigned September 1 to become professor of zoology and research zoologist, but is continuing to serve as acting dean and director. S. P. Clark, assistant professor of agronomy and assistant agronomist, also resigned September 1 to become expert in charge of cotton investigations for the Turkish Government, with headquarters at Istanbul.

Recent appointments include Dr. Alton H. Finch as assistant professor of horticulture and assistant horticulturist; Dr. Gladys Hartley as assistant professor of home economics, succeeding Dr. Bernice C. Wait, resigned to become assistant research professor in home economics in the Massachusetts Station; Faye Jones as associate professor of vocational education in home economics, vice Ruth T. Lehman, resigned to take up graduate work; Fred Draper as extension specialist in horticulture; and H. N. Watenpaugh as extension specialist in agronomy and irrigation practice.

Purdue University and Station.—H. K. Riley, assistant entomologist, has resigned to accept a teaching position in Louisiana Southwestern Institute and has been succeeded by G. E. Gould, assistant entomologist in the Virginia Truck Station. L. H. Schwartz has resigned as associate professor and research assistant in poultry husbandry to engage in farming near Trumansburg, N. Y., and has been succeeded by E. E. Schnetzler, assistant poultry husbandman in the Oklahoma Station. O. B. Riggs has resigned as assistant agronomist to become agricultural agent of Posey County. Dr. W. B. Stout, instructor and assistant in rural economics in the Ohio State University and Station, has been appointed extension economist in marketing vice W. W. Underwood, who was killed in an automobile accident in March.

Kansas College and Station.—A new plant physiology laboratory has been fitted up in Albert Dickens Hall for station work.

Dr. M. C. Sewell, associate professor of soils, resigned August 31 to become general secretary of the Sigma Nu Fraternity. Leave of absence has been granted to Dr. John H. Parker, professor of agronomy and in charge of station work in plant breeding, to serve for one year as acting professor of plant breeding at Cornell University.

On October 1 Dr. E. B. Working, associate professor in the department of milling industry and in charge of wheat and flour investigations, returned from leave of absence for research with the division of plant biology of the Carnegie Institution at Tucson, Ariz. Floyd B. Wolberg has been appointed instructor in dairy husbandry, effective October 16, vice H. J. Brooks, resigned to carry on graduate work at Cornell University. G. A. Filinger, assistant entomologist of the Ohio Station, has been appointed assistant professor of horticulture and pomologist. E. W. Johnson, forest nurseryman at the Fort Hays Substation, has been added to the instruction staff of the college on a half-time basis.

Massachusetts College and Station.—Lyle L. Blundell has been appointed professor of horticulture, vice C. H. Thompson, deceased; Mildred Briggs,

assistant professor of home economics vice Marion L. Tucker; Wellesley C. Harrington, extension specialist in agricultural engineering; Roy E. Moser, specialist in farm management; J. C. Baker, extension editor (radio programs); James E. Thigpen, research assistant in farm management; William S. Mueller, assistant research professor of dairying vice Kenneth E. Wright, resigned to continue graduate work; and Robert E. Young, assistant research professor of vegetable gardening at the Waltham Field Station.

Michigan Station.—Dr. C. S. Robinson, station chemist, resigned July 17 to accept a position in the school of medicine of Vanderbilt University.

New York State Station.—Dr. Lucius Lincoln Van Slyke, station chemist from 1890 until his retirement in 1929 and from 1920 to 1929 also professor of dairy chemistry in Cornell University, died September 30 at the age of 72 years. A native of New York State, he received the B. A., M. A., and Ph. D. degrees from the University of Michigan in 1879, 1881, and 1882, and served in that institution as instructor in chemistry from 1882 to 1885 and as lecturer in chemistry from 1888 to 1889. He was also professor of chemistry in Oahu College and chemist to the Hawaiian Government from 1885 to 1888.

Dr. Van Slyke's long service at Geneva included a year as acting director of the station in 1895–96. He was best known, however, for his extensive contributions to chemical research, especially in the chemistry of milk and milk products, and as head of the analytical work with feeding stuffs, fertilizers, insecticides, and fungicides. He was active in the Association of Official Agricultural Chemists, serving as its president in 1900. He was also a frequent contributor to the literature of agricultural chemistry, his work including 130 station publications, many articles in scientific journals, and several textbooks, among them Modern Methods of Testing Milk and Milk Products, Fertilizers and Crops, and, with C. A. Publow, The Science and Practice of Cheese Making.

Tennessee Station.—The resignations are noted of H. L. Fackler, associate horticulturist, to enter commercial work; J. A. McClintock, horticulturist and associate plant pathologist, to accept a position as associate professor of horticulture in Purdue University and associate horticulturist in the Indiana Station; and Helen B. Hutchens, assistant plant pathologist, to pursue further studies. Brooks D. Drain, assistant professor of pomology at the Massachusetts College, has been appointed associate horticulturist, and Dr. Paul H. Hornburg, assistant plant pathologist.

Washington College and Station.—Rex E. Willard, professor of farm management and rural economics and farm management demonstrator in the North Dakota College, has been appointed head of the department of farm management and agricultural economics in the College of Agriculture and head of the division of farm management and agricultural economics in the station, filling the vacancy due to the death of George Severance and effective about October 15.

Babcock Memorial Statue.—*Science* announces that efforts are under way to raise a fund of approximately $30,000 for a statue of the late Dr. S. M. Babcock in appreciation of his dedication of the Babcock test to the public and for his other contributions to dairy science. Prof. E. H. Farrington of the University of Wisconsin is serving as treasurer of this fund.

Changes in Canadian Personnel.—Dr. Frank T. Shutt has retired as Dominion chemist and assistant director of experimental farms of the Canadian Department of Agriculture, thereby terminating a public service of 44 years. L. E. Kirk, professor of field husbandry at the University of Saskatchewan since 1922, has been appointed Dominion agrostologist at the Central Experimental Farm, Ottawa. Allen Deacon, Ph. D. (University of Wisconsin, 1931), has been appointed Dominion animal geneticist.

Awards of Medals and Prizes.—Announcement is made that the second competition for the Maynard Ganga Ram Prize will close December 31, 1932. This prize of 3,000 rupees is "open to all irrespective of caste, race, or nationality," and will be awarded for "a discovery or an invention or a new practical method tending to increase agricultural production in the Punjab on a paying basis." Application should be made to the director of agriculture, Lahore, Punjab.

The 1930 Harmon Award of a gold medal and $400 in cash has been presented to Thomas Monroe Campbell, engaged in agricultural extension work among negroes for about 25 years and at present field agent for the Gulf States in the U. S. D. A. Office of Cooperative Extension Work. This award was established in 1925 to assist in increasing public appreciation of the creative efforts of members of the negro race and had not previously been awarded in the field of agriculture and rural life.

Dr. L. H. Bailey has recently received the Honorary Award Medal of the Garden Club of America "in recognition of his outstanding contributions to horticulture," and the Arthur Hoyt Scott Garden and Horticultural Medal of Swarthmore College with $1,000 in cash (E. S. R., 61, p. 500) for his work in creating and developing a wider interest in horticulture and in gardening.

The Oberly Memorial Prize, awarded triennially by the Eunice Rockwood Oberly Memorial Fund of the American Library Association for the best bibliography in agriculture, has been bestowed upon Everett E. Edwards, associate agricultural economist of the division of agricultural history, U. S. D. A. Bureau of Agricultural Economics, for a contribution entitled A Bibliography of the History of Agriculture in the United States.

Necrology.—Dr. Russell A. Oakley, principal agronomist in charge of the division of forage crops and diseases of the U. S. D. A. Bureau of Plant Industry, died August 6, after a long illness, at the age of 50 years. A native of Kansas and a graduate of the Kansas College in 1903, he had served the Department continuously since graduation in connection with its seed distribution, as chairman of the seeds stock committee during the World War, as assistant chairman of the Federal Horticultural Board, as a member of the advisory Federal Plant Quarantine Board, and in various other capacities. As an agrostologist he had become widely known for his interest in the improvement of fine turf grasses, serving as chairman of the research committee of the U. S. Golf Association Greens Section and doing much to stimulate scientific studies in this field. He was given the honorary degree of doctor of science by the Iowa College in 1920.

Peter J. Wester, widely known as a tropical horticulturist, died in Manila August 18 at the age of 53 years. A native of Sweden and a graduate in 1895 of Gefleborg Agricultural Folk High School, he came to the United States in 1904 and was engaged in horticultural work for the U. S. Department of Agriculture at its Subtropical Laboratory and Garden at Miami, Fla., until 1910. He had subsequently been connected with horticultural work in the Philippines, establishing the Lamao Experiment Station in 1912.

Dr. Archie H. Kirkland, consulting economic entomologist, died August 29 at the age of 58 years. A native of Massachusetts, he received from the Massachusetts College the B. S. degree in 1894 and the M. S. degree in 1896. He was a pioneer worker in the campaign against the gipsy moth in that State from 1894 to 1900 and superintendent of its activities from 1905 to 1908.

Edmond Rabaté, director of the National Institute of Agriculture of France and administrator of the National Institute of Colonial Agriculture, died April 18.

EXPERIMENT STATION RECORD

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RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL AND BIOLOGICAL CHEMISTRY

Studies on the transformations of iron in nature.—III, The effect of CO_2 on the equilibrium in iron solutions, H. O. Halvorson (*Soil Sci., 32 (1931), No. 2, pp. 141–165*).—The present paper continues a series (E. S. R., 58, p. 622) of contributions from the University of Minnesota presenting a theoretical and experimental study of equilibrium conditions in iron solutions as affected by atmospheric oxygen and carbon dioxide, together with an investigation of "some of the activities of microorganisms associated with solution and precipitation as well as oxidation and reduction of iron" in the light of equations developed in the study above noted of equilibrium conditions.

"Under anaerobic conditions in dextrose or peptone media, heterotrophic microorganisms may dissolve metallic iron. They will also dissolve and reduce iron present as ferric hydroxide. These changes result from a decrease in the oxygen pressure and the formation of acid. These transformations may occur even at reactions close to neutrality. Precipitation of ferrous carbonate may result under anaerobic conditions when CO_2 is formed by the breakdown of organic compounds. Activity of iron bacteria appears to occur only under environmental conditions favorable to spontaneous oxidation by chemical agencies. The iron content of natural water in iron springs is not reduced by the iron bacteria to a concentration below which it will go by a pure chemical reaction under identical conditions. The solution and precipitation of iron in nature are seen to be associated with equilibrium conditions which depend upon the oxygen tension, carbon dioxide tension and acidity, and the presence of organic compounds.

"These conditions may be modified very extensively by bacterial activity. Careful analysis of the activities of the so-called iron bacteria indicates that their contributions to transformations of iron are confined solely to its precipitation. It is of great importance to note that their activity appears to occur only under those conditions in which the iron precipitates spontaneously, that they do not carry on the reaction beyond the degree arrived at by spontaneous precipitation. On the other hand it has been shown that bacteria not recognized as iron bacteria greatly modify their environmental conditions so as to bring about either the solution or precipitation of iron. Their effect upon the solution of iron can hardly be overemphasized in that they can effect changes favoring solution which do not occur spontaneously. Although the deposition of the oxide is seen to occur readily as a spontaneous precipitation, the deposition of the carbonate in nature indicates that the heterotrophic bacteria may also be of major importance in this transformation."

"*It would appear then that the importance of the true iron bacteria has been overemphasized, whereas the importance of the heterotrophic bacteria in transformations of iron in nature has not been fully appreciated.*"

The characterization of proteins by means of affinity determinations [trans. title], G. ETTISCH, H. SACHSSE, and W. BECK (*Biochem. Ztschr., 230* (*1931*), *No. 1–3, pp. 68–92, figs. 13*).—The paper is concerned with the elaboration and application of a method designed to make possible the identification of proteins. The biuret reaction was investigated with respect to the electromotive forces involved in the chain:

$$\mathrm{Cu} \left| \begin{matrix} \text{Protein} + \mathrm{NaOH} \\ + \\ \mathrm{CuSO_4} \end{matrix} \right| \mathrm{KCl} \left| \mathrm{CuSO_4} \right| \mathrm{Cu.}$$

From the measurements of e. m. f. in the chain just indicated and from changes in the depolarization, the viscosity, and the light absorption (the property last named having been measured after the addition of the copper sulfate), it was concluded that under the experimental conditions described the action of the sodium hydroxide reaches a definite end point after about 24 hours. Experiments of the type indicated led also to the conclusion that the protein fraction insoluble after electrodialysis (the globulin) differs characteristically from the soluble, or albumin, fraction. These differences showed themselves especially in the electrochemical properties of solutions of high protein concentration. The quantity Φ (e. m. f. as measured in the above specified system) rose much more rapidly with increasing sodium hydroxide concentration in the case of the albumin than in that of the globulin; and with increasing copper content, Φ dropped in the case of the albumin much more rapidly than in that of the globulin. From the last-named data are drawn the inferences (1) that the copper-binding group in the albumin possesses an affinity for copper greater than that of the corresponding group in the globulin, and (2) that the globulin takes up copper at a greater number of points than does the albumin. Further conclusions of a similar character are also stated.

With respect to the methodology of measurements of the type discussed, it is considered (1) that the affinity measurements should be made after the completion of the action of the alkali upon the protein (about 24 hours) if sharp differences are to be observed; (2) that the measurements are best made at high protein concentrations; and (3) that it is practically sufficient to determine the affinity at a given protein concentration in relation to the concentration of the alkali and of the copper.

On the viscosity of alkali-protein solutions [trans. title], G. ETTISCH and H. SACHSSE (*Biochem. Ztschr., 230* (*1931*), *No. 1–3, pp. 115–128, figs. 5*).—Within a wide range of reaction a quantitatively measurable flow elasticity could be determined neither in albumin nor in globulin solutions. Purely qualitative indication could be obtained, however, of an elasticity, possibly a form elasticity, appearing when a few cubic centimeters of copper sulfate solution were added to highly concentrated solutions either of alkali albumin or of alkali-globulin. Under certain conditions such albumin and globulin solutions were even caused to become solid by the addition of the copper sulfate.

The action of alkali upon proteins was found an express function of the time. The viscosity rose with increasing additions of alkali; but this effect appeared only after the alkali concentration passed a certain critical valu

(termed the saturation concentration), below which the alkali remained without influence. Various other results and conclusions are recorded.

On the question of the chemical individuality of the serum proteins [trans. title], G. ETTISCH and H. SACHSSE (*Biochem. Ztschr.*, *230* (*1931*), *No. 1–3, pp. 129–135, figs. 2*).—The authors applied the method for the measurement of the copper-binding affinity of proteins above noted, drawing from their results the conclusions that (1) the euglobulin (precipitated by one-third of the saturation quantity of ammonium sulfate) corresponds to the globulin fraction prepared by means of electrodialysis; (2) the paraglobulin, or the fraction precipitated by one-half saturation with ammonium sulfate, is to be regarded as an individual chemical compound, taking a definitely characterized place between the globulin and the albumin; and (3) a direct conversion of albumin to globulin appears, in the light of the experiments here recorded, decidedly improbable, and a masked transformation, on the other hand, should be detectable by the method employed. These and other indications of the experiments described are discussed in some detail.

The influence of lecithin on the stability of serum proteins [trans. title], S. WENT and F. FARAGÓ (*Biochem. Ztschr.*, *230* (*1931*), *No. 1–3, pp. 238–244, figs. 3*).—In mixtures of aqueous lecithin emulsions with sera, the proportions of the individual serum protein fractions were found to change in such a manner between the quantity, on the one hand, of euglobulin and pseudoglobulin I, and that, on the other hand, of pseudoglobulin II and albumin that there existed a well-marked reciprocity. It is considered that the experiments reported support the conclusion that euglobulin constitutes a colloidal complex of pseudoglobulin and lecithin. These same relations may, however, it is noted, exist as between the globulin precipitable by 21.5 per cent sodium sulfate (pseudoglobulin II) and the albumin.

Within the limits of the two principal types of serum protein fractions there appear to occur, according to the authors, dispersoids which are not well defined and of which the stability, defined as the precipitability by neutral salts, is markedly affected in accordance with the quantity present, by suspended or dissolved lecithin.

A study of certain properties of the provitamin A, E. J. QUINN and J. G. HARTLEY (*Jour. Biol. Chem.*, *91* (*1931*), *No. 2, pp. 633–639, figs. 2*).—In this continuation of studies on the behavior of vitamin A from plant sources, or provitamin A as it is called in recognition of the recent findings regarding the relationship of carotene to vitamin A, the effect of certain adsorbents and organic solvents was studied.

Petroleum ether extracts of dried carrot root were first treated with norite and Lloyd's reagent. Both of these adsorbents readily removed the color from the solution, 2.5 gm. of the former and 8.5 of the latter adsorbent being required to decolorize completely 50 cc. of the yellow extract used. The colorless filtrates gave negative tests for vitamin A with both the antimony trichloride color reaction and feeding experiments. Since evidence has been reported showing that the vitamin A of liver oils is not adsorbed by norite, these results are thought to indicate the absence in the filtrates of vitamin A as found in liver oils.

In an attempt to remove the active factor from the adsorbent by the use of various organic solvents, chloroform removed the pigment readily from norite but only slightly from Lloyd's reagent, and the opposite was true of ethyl ether. The colored extracts thus obtained gave positive results with the antimony trichloride color reaction, but negative results when evaporated on corn starch and fed as the source of vitamin A. That the failure in feeding

experiments was due to destruction of the pigment by the solvent during the evaporation was shown by the fading of the color of such preparations after a day or two. The destruction of the pigment and active material by the solvents was further indicated by the loss of color when certain extracts of carrots were exposed to light. The color of the chloroform extract was affected most, followed by that of ethyl ether, while that of petroleum ether was not at all affected. It was found possible to extract some of the active material from norite but not from Lloyd's reagent by the use of peanut oil. When the activated norite and Lloyd's reagent were fed to rats as the sole source of vitamin A, some growth was secured with the norite but not with Lloyd's reagent. Feces from rats fed activated norite were found to contain some of the active material, but this was not true of Lloyd's reagent, thus indicating a destruction of the vitamin at some stage in the test period.

Pure carotene and vitamin A [trans. title], D. Van Stolk, J. Guilbert, H. Pénau, and H. Simonnet (*Compt. Rend. Acad. Sci.* [*Paris*], *192* (*1931*), *No. 23*, *pp. 1499–1501*).—The authors report the extraction from carrots of carotene which, on purification by crystallization, had a melting point of 179° C. The crude carotene was curative for rats in daily doses of 0.005 mg. and after crystallization in doses of 0.002 mg.

The method used consisted in extracting dried powdered carrots with some volatile solvent such as petroleum ether or carbon disulfide, removing the solvent by evaporation, dissolving the residue in anhydrous toluene and alcohol, and saponifying it by boiling for 10 minutes with an excess of sodium ethylate in absolute alcohol, and adding hot water to dissolve the soap and leave the carotene in the toluene solution. This extract is washed with hot water, dehydrated with anhydrous sodium sulfate, evaporated to dryness under nitrogen, dissolved in carbon disulfide, and precipitated with four volumes of absolute alcohol. After standing overnight in the ice box, the mixture is filtered and the crystals of carotene are dried in vacuo.

Carotene and vitamin A [trans. title], D. Van Stolk, J. Guilbert, and H. Pénau (*Compt. Rend. Acad. Sci.* [*Paris*], *193* (*1931*), *No. 3*, *pp. 209*, *210*, *figs. 2*).—In the preparation of carotene, as noted above, it was found impossible to precipitate more than half of the total carotene as determined colorimetrically. This led to a spectrographic comparison of the total lipoidal extract of the carrot, the carotene of first crystallization, and the dried extract of the mother liquor. The pigment in the mother liquor, while not identical with the crystalline carotene, was proved not to be xanthophyll. It was concluded that there are several forms of carotene in the carrot, differing in physicochemical properties but all possessing physiological activity.

Spectrographic data concerning vitamin A and liver oils, R. A. Morton, I. M. Heilbron, and A. Thompson (*Biochem. Jour.*, *25* (*1931*), *No. 1*, *pp. 20–29*, *figs. 7*).—Further data (E. S. R., 59, p. 792) are given on the absorption spectra of liver oils and concentrates and of the blue solutions with antimony trichloride of liver oils, liver oil concentrates, and various decomposition products. The principal observations are summarized essentially as follows:

The ultra-violet absorption of cod-liver oils either in thin films or alcoholic solutions is characterized by a single well-defined maximum at 320 to 330μμ. The persistence of this band is variable, probably due to the fact that some fairly absorbent substances other than vitamin A may be present in genuine cod-liver oil. It is considered that the ultra-violet absorption spectrum of any liver oil can be regarded as fixing an upper limit to its vitamin A potency. Nearly every cod-liver oil showed selective absorption in the region of 290 to 295μμ, with an inflection at 280μμ. The absorption at this point did not par-

allel the vitamin D potency, nor could it be associated with the ergosterol content. With a few samples of fish-liver oils other than cod-liver oil, the absorption at 328$\mu\mu$ was high and apparently due to vitamin A, although the band appeared only as an inflection and was partially masked by an intense abnormal absorption of unknown origin.

The majority of pale medicinal oils showing a clear absorption band at 328$\mu\mu$ gave with antimony trichloride a blue color characterized by a single sharp absorption band at 604 to 608$\mu\mu$. The antimony trichloride solutions of crude cod-liver oils of high potency frequently showed additional selective absorption in the region 565 to 585$\mu\mu$.

The blue solutions with liver oil concentrates were characterized by a sharp band with its maximum at 620 to 624$\mu\mu$. Some also showed a less intense band with a maximum at 582 to 593$\mu\mu$. When concentrates were diluted with an inactive oil so that the potency of the product was of the same order as that of cod-liver oil, the absorption maximum in the color test reverted from 620 to 624$\mu\mu$ to from 604 to 608$\mu\mu$. When concentrates were treated with sodium ethoxide, which destroyed vitamin A, acids were formed characterized by a series of well-defined absorption bands with maxima near 394, 375, 350, 330, 316, 302, 282, 271, and 260$\mu\mu$. These acids were not ordinary fatty acids and were *not present as simple glycerides in the original oil.*

Spectrographic data of natural fats and their fatty acids in relation to vitamin A, A. E. GILLAM, I. M. HEILBRON, T. P. HILDITCH, and R. A. MORTON (*Biochem. Jour., 25 (1931), No. 1, pp. 30–38, figs. 9*).—This study of the absorption spectra of natural fats and their related acids was prompted by the observations noted above concerning the various well-defined bands in the absorption spectra of vitamin A concentrates in which the vitamin had been destroyed by treatment with sodium ethoxide.

Absorption curves are given for the total acids of cod-liver oil, halibut-liver oil, butter, whale oil, shark-liver oil, olive oil, and cottonseed oil. All of the oils containing vitamin A yielded on hydrolysis acids with highly characteristic banded absorption spectra which were absent from the corresponding acids of vitamin A-free oils.

The authors suggest that "under hydrolytic conditions a substance (or substances) accompanying vitamin A gives rise to acid decomposition products which display intense selective absorption. We suggest that even under the ordinary mild conditions of saponification, sufficient of this acidic decomposition product is formed to give rise to the observed spectra. That the acid decomposition products are in some way connected with the presence of vitamin A is indicated by the distinctly different absorption curves obtained with the acids from the nonvitamin A-containing olive or cottonseed oils."

Experiments on the isolation of the antineuritic vitamin, A. SEIDELL and V. BIRCKNER (*Jour. Amer. Chem. Soc., 53 (1931), No. 6, pp. 2288–2295*).—Attempts to obtain a concentrate of antineuritic vitamin on a larger scale by adsorption on fuller's earth and subsequent purification by benzoylation without the use of precipitating agents (E. S. R., 65, p. 109) are reported and discussed.

An improvement was made in the method of preparing the activated solid by removing the supernatant liquid after the adsorption on fuller's earth by decantation, with subsequent washing of the remaining solid with slightly acidified water (1 cc. of concentrated HCl per liter) one or more times. This slight modification is thought to bring about the removal of organic constituents which interfere with later steps of the process.

In the subsequent extraction and concentration of the vitamin, the brown precipitate which separates during the vacuum distillation was found by

M. I. Smith in rat experiments to be very rich in vitamin B_2 or G. Dried samples of the precipitate are usually about 5 times as active in this vitamin as dried yeast, and by further purification can be concentrated to an activity of more than 10 times that of the original yeast.

It has been found that in the alcohol precipitation stage of the procedure the removal of inactive constituents can be effected only at the expense of considerable losses of the active compound. "Accumulated experience seems to show that the quality and yield of the final concentrate obtained by the subsequent steps of the process vary inversely with the percentage of the original vitamin present at the 50 per cent alcoholic solution stage. The most active concentrate which has so far been made was obtained from an alcoholic solution in which there was only about 5 per cent of the antineuritic vitamin of the yeast from which it was prepared."

In the final process of benzoylation and acetone precipitation, marked variations in the yield and quality of the final acetone precipitate have been found to occur as the result of only small variations in the concentration of reagents and temperature of the reaction. Final products have been obtained varying in activity from 0.3 to 0.03 mg. in terms of curative rat doses. It is noted that the most active sample obtained has an activity about one-fourth greater than that of the Jansen-Donath crystals and more than twice as great on the nitrogen basis. Although the more active samples had the lowest nitrogen content, there was no close parallelism between nitrogen content and activity, thus suggesting that considerable amounts of nonvitamin nitrogenous compounds are probably still present in the more active samples.

A critical study of the antimony trichloride color test for vitamin A, W. R. BRODE and M. A. MAGILL (*Jour. Biol. Chem., 92 (1931), No. 1, pp. 87–98, figs. 4*).—Using a Bausch and Lomb spectrophotometer, the authors have studied the absorption spectra of the blue solutions produced in the antimony trichloride test for vitamin A, and have found that while such solutions ordinarily have two different absorption bands, as previously noted by Wokes (E. S. R., 60, p. 790), at suitable concentrations only one of the two bands is produced. One of the two original bands is at 578$\mu\mu$ and the other at 608$\mu\mu$. Both of these bands fade on standing, and new bands develop at 472$\mu\mu$ and 532$\mu\mu$.

The conditions of concentration were determined by means of which only the 608$\mu\mu$ band is produced. Cod-liver oils observed under these conditions yielded extinction coefficient values of the 608$\mu\mu$ band which were proportional to the concentration of the oil.

The technic followed in the examination of oils in this way is described in detail.

The activation of ergosterol with radium emanation, R. B. MOORE and T. DEVRIES (*Jour. Amer. Chem. Soc., 53 (1931), No. 7, pp. 2676–2681*).—Evidence is reported indicating that a reasonably active viosterol can be produced by the activation of ergosterol with radium emanation. The activation has been carried out on four different occasions under different experimental conditions and with two varieties of ergosterol. As tested on rats by a modified line test, ergosterol activated in this way may have a potency of about one-hundredth that of a good grade of ultra-violet irradiated ergosterol. Stirring the sample while under the influence of the emanation increased the speed of activation, but not the potency of the product. There was no appreciable loss in potency when the activation was carried on with a twenty-fold excess emanation. Decomposition products were formed in all cases.

The spectrophotometric micro determination of phosphorus [trans. title], T. THORELL (*Biochem. Ztschr., 230 (1931), No. 1–3, pp. 1–9*).—The Fiske

Subbarow method (E. S. R., 55, p. 310) for the colorimetric determination of phosphorus was slightly modified in certain details, and the color was determined by means of the spectrophotometer. By thus modifying the procedure, the author found it possible to determine phosphorus without the use of a standard comparison solution, and, even in the case of organic substances, the element could be determined in quantities of from 0.01 to 0.05 mg. to an accuracy of about ± 2 per cent. The procedure is given in detail, and effects of variations in the relative quantities of the several reagents used are briefly discussed.

Figures illustrative of the last-named effects are presented, together with the results of a number of determinations of the phosphorus contents of lecithin preparations and of some other organic substances of biological origin.

Sauerkraut, C. S. Pederson (*New York State Sta. Bul. 595 (1931), pp. 23*).—The subject is presented largely on a basis of the station studies. "The effect of the use of starters prepared from various bacterial cultures is discussed, showing that most of the possible types of starters are detrimental to a good fermentation. The temperature of fermentation, the proper covering of the kraut, and the correct salt content are of major importance in a proper fermentation."

Various types of spoilage, as those brought about by direct contact with air, by lack of kraut juice, by the use of an inadequate or of an excessive proportion of salt, by incorrect temperature, etc., are taken up.

Studies on the chemistry of grape juice, E. L. Green and Z. I. Kertesz (*New York State Sta. Tech. Bul. 181 (1931), pp. 14*).—It is concluded that "the process of enzymic clarification of grape juice described by Willaman and Kertesz [E. S. R., 65, p. 712] does not cause any appreciable changes in the constituents of grape juice so far as they have been determined, with the exception of the pectin, two-thirds of which is commonly removed." The process is shown to be associated with the appearance of a precipitate which is regarded as characteristic of the process. The precipitate is composed of carbohydrate material, probably several substances, together with adsorbed or occluded incidental constituents of the grape juice. Evidence is presented to show that during a storage of several months not only does the tartaric acid become less, but there is considerable decrease in the pectin content of the juice.

METEOROLOGY

Monthly Weather Review, [May–June, 1931] (*U. S. Mo. Weather Rev., 59 (1931), Nos. 5, pp. 175–217, pls. 17, figs. 21; 6, pp. 219–257, pls. 12, figs. 17*).—In addition to detailed summaries of climatological data and weather conditions for May and June, 1931, solar and aerological observations, and bibliographical and other information, these numbers contain the following contributions:

No. 5.—Two Series of Abnormal Winters (illus.), by T. A. Blair (pp. 175–181); Storm Warnings on the Great Lakes, by G. A. Marr (pp. 181–183); Significance of Air and Sea Temperatures Obtained on Cruise VII of the "Carnegie" (illus.), by K. B. Clarke (pp. 183–185); The Selected-Ship Program for Ocean-Weather Reporting by Radio, by E. B. Calvert (pp. 185, 186); The Radiation Conference at Berlin and Potsdam, February 23–28, 1931, by H. H. Kimball (pp. 187, 188); Flying Weather in the Corpus Christi Area, by J. P. McAuliffe (pp. 188, 189); Pilot-Balloon Observations at Havre, Mont., by F. A. Math (pp. 189–191); Evaporation in the Eastern Caribbean (illus.), by C. L. Ray (pp. 192–194); The Pioneer Meteorological Work of Elias Loomis at Western Reserve College, Hudson, Ohio, 1837–1844 (illus.), by E. R. Miller (pp. 194,

195); Great Dust Storm in Washington and Oregon, April 21–24, 1931 (illus.), by D. C. Cameron (pp. 195–197); Tornado Strikes Swiftly Moving Train (illus.), by R. J. McClurg (pp. 198, 199); and Table for Facilitating Computation of Potential Temperature (illus.), by J. C. Ballard (pp. 199, 200).

No. 6.—Ground Plan of a Dynamic Meteorology, by H. C. Willett (pp. 219–223); Windstorm in the Los Angeles Area November 22, 1930, and Some Effects of Wind Flow in a Mountainous Region (illus.), by G. M. French (pp. 223–225); The Gothenburg, Nebr., Tornadoes June 24, 1930 (illus.), by A. R. Oliver (pp. 225–229); Hail Damage in Iowa, by C. D. Reed (pp. 229, 230); Melon Frost Forecasting in the Umpqua Valley, Oreg. (illus), by E. H. Fletcher (pp. 230–232) (see below); Weather Conditions Affecting the Port of New Orleans, by W. F. McDonald (pp. 232, 233); Note on J. F. Brennan's Method of Determining the Altitude in the Atmosphere above Sea Level Where the Freezing Point of Water Occurs (illus.), by A. Ångström (p. 234); and Analysis of the Precipitation of Rains and Snows at Mount Vernon, Iowa, by L. L. Cottral (p. 235).

The drought of 1930 in West Virginia, L. K. HERNDON and J. R. WITHROW (*Jour. Amer. Water Works Assoc., 23 (1931), No. 5, pp. 698–707, figs. 3*).—Detailed data for rainfall deficiency in the State in 1930 are given and discussed, with special reference to effect on stream flow, public water supply, health, and various industries. It is stated that the drought "was of greater length and greater intensity than any drought previously recorded in the climatological history of the State. . . . The average deficiency of rainfall for the State from December 1, 1929, to November 1, 1930, was 17.08 in., with a maximum of 26.59 in. and a minimum of 8.20 in." Incidentally, it was observed that "the low water condition in the Ohio River caused the hardness of the water to increase at Wheeling to 180 p. p. m. in the latter part of August, which is about three times the normal."

Resistance thermometers for the measurement of relative humidity or small temperature differences, D. C. ROSE (*Canad. Jour. Research, 5 (1931), No. 2, pp. 156–161, fig. 1*).—This article describes the use of the bridge circuit to measure relative humidity, especially at low temperatures. "In the bridge circuit the two thermometers form two arms of a bridge, so that temperature variations in the leads are automatically compensated. A slide wire forms a part of the bridge circuit, and the constants are so arranged that a very simple relation gives the difference in temperature of the wet and dry bulbs." Results of preliminary comparison of the resistance thermometer with mercury thermometers are given.

Air drainage and formation of frost, E. S. ELLISON (*Bul. Amer. Met. Soc., 12 (1931), No. 8–9, pp. 147, 148*).—This is an abstract of a paper presented at the Pasadena meeting of the American Meteorological Society in June, 1931, in which "a theory is introduced to show that the drainage of cold air down an irregular slope is not a smooth, steady flow, but comes in a series of irregular gusts of wind that cause the temperature even in closed frost pockets to fluctuate in a spasmodic manner. The flow of air streams in narrow valleys is discussed, and the occurrence of warm and cold spots is shown to be due to the configuration of the bench lands."

Melon frost forecasting in the Umpqua Valley, Oreg., E. H. FLETCHER (*U. S. Mo. Weather Rev., 59 (1931), No. 6, pp. 230–232, figs. 2*).—This article briefly discusses the influence of fog, wind, and other conditions on the occurrence of early and late frosts in the melon growing region in the general vicinity of Roseburg, Oreg., and describes the frost forecasting service which has been set up there. Wind is usually extremely light and not an important factor, but

"an essential prerequisite to frost and minimum temperature forecasting in this region is the foretelling of the occurrence of morning fog, together with the degree of density, and the approximate hour of beginning, since occasionally there will be some damage before the fog begins to retard the fall in temperature." The forecasts have proved of value not only in indicating the earliest date when melons may be safely planted, but as warnings of frost danger in the fall. Knowledge of "the kind of weather that is expected to prevail not only determines the time but also the depth the seed should be planted for best results," and aids in removing one of the major risks, namely, that of uncertain stands.

The correlation of weather conditions with outbreaks of potato blight, S. P. WILTSHIRE (*Quart. Jour. Roy. Met. Soc. [London], 57 (1931), No. 240, pp. 304–316*).—Supplementing and extending the work of Löhnis, Van Everdingen (E. S. R., 58, p. 342), and others, in an effort to determine more definitely the relation between specific meteorological factors and outbreaks and severity of potato blight, the author reaches the conclusion that "progress of research in this subject would appear to be more promising through an intensive study of the fungus as it occurs in the field than through an extensive statistical examination of the relation of outbreaks to weather records. . . . Both kinds of investigation are needed, however, and much remains to be done to supplement the achievement of the Dutch workers in initiating the attack on the problem."

Report on the phenological observations in the British Isles from December, 1929, to November, 1930, J. E. CLARK, I. D. MARGARY, R. MARSHALL, C. J. P. CAVE, and L. C. W. BONACINA (*Quart. Jour. Roy. Met. Soc. [London], 57 (1931), No. 241, pp. 345–404, figs. 8*).—This is a detailed review and discussion of observations during the year. The report is based on data from 498 observing stations. Brief reference is made to the practical application of such observations.

Rainfall of the year was decidedly in excess of the normal, and temperature was also abnormal in certain respects. Farm and garden conditions were, as a rule, bad. The unseasonable conditions were reflected to some extent in the course of phenological events, as is shown in a comparison of isotherms, isohels, isophenes, and isakairs for the year.

SOILS—FERTILIZERS

[Soil and fertilizer investigations of the Nebraska Station] (*Nebraska Sta. Rpt. [1930], pp. 18–20*).—This work has included the following, continuing earlier studies (E. S. R., 63, p. 614).

The relation of weather, cultural practices, and soil conditions to nitrification in Nebraska soils.—Sodium nitrate continued superior to ammonium sulfate, applications of Calurea having been found of intermediate value. Calurea applied in April "was slightly superior to that applied early in May."

A study of the factors which affect the tilth of soils.—Special apparatus was developed for the study of friction. It was found that the coefficient of friction on metal is independent of velocity over the metal surface, of area of soil in contact with the metal surface, and of pressure.

"The soil variables studied were texture, structure, moisture, organic matter content, and lime content. Coefficient of friction at moisture equivalent wetness varied from 0.500 in sandy soils to over 1.000 in clay soils. Coarse granulation decreased and fine granulation increased the coefficient of friction. Within the limits of the moisture equivalent the coefficient of friction increased with the moisture content. Changes in organic matter content did not signifi-

cantly affect friction in a definite direction, but increased it in some cases and decreased it in others. Additions of lime to acid soils decreased the coefficient of friction from 10 to 20 per cent."

An outline of the method in use for a study of the effect of various sources of soil organic matter is given.

Cooperative fertilizer experiments.—It is noted that 100 farmers cooperated, using 65 tons of "treble superphosphate," and that "inspection of a number of fields indicates that on certain soils a considerable response will be found to the application of superphosphate."

[Soil investigations of the New Jersey Stations], J. G. Lipman and A. W. Blair (*New Jersey Stas. Rpt. 1930, pp. 55–58, 308–318*).—With respect to the continuous fertilizer experiments, the present is a continuation of the previous year's record (E. S. R., 63, p. 318). Current items also are included.

Field and cylinder experiments.—On plats without lime, nitrogen recoveries from sodium nitrate were 69.5 and 61.7 per cent, followed by 46.3 per cent from calcium cyanamide. On limed plats sodium nitrate gave 71.9 per cent recovery from applications at the rate of 160 lbs., 33.4 per cent from applications at the rate of 320 lbs. to the acre. From ammonium sulfate the recovery was 44.5 per cent on limed plats, but the salt was useless on unlimed plats. Calcium cyanamide gave a higher recovery on an unlimed plat (pH 5.8) than on a limed plat (pH 7.0). Nitrogen from organic sources and from 16-ton applications of manure was less well recovered than was that from inorganic fertilizers. Top-dressing with sodium nitrate increased both yield and nitrogen content of the dry matter of oats "with very few exceptions."

With reference to the phosphate requirements of potatoes "there is indication that heavy applications of superphosphate put out of action soluble compounds which would otherwise be prejudicial to the growing of potatoes in a soil as acid as that required for the control of potato scab"; and heavy applications were found not to depress the yield.

"Work with concentrated fertilizers has been continued with satisfactory results in most cases. . . . With corn good yields were obtained with a fertilizer containing a total of 50 units of plant food."

Experiments with magnesian and with nonmagnesian limestones were successfully continued, the indication being that 1 ton of limestone of either type applied once in 5 years suffices to keep the Sassafras loam, on which this experiment was carried out, near the neutral point. From this result it was inferred also that "much of the soil in the southern counties, where vegetables and fruits are widely grown, will probably not require more than 2,000 lbs. of ground limestone or an equivalent amount of hydrated lime once in 5 years to maintain it near the neutral point."

Soil microbiology.—In an investigation into the decomposition of organic matter by microorganisms as affected by temperature and moisture, it was found that "the higher the temperature, the more rapid is the decomposition of plant residues and the greater is the relative amount of nitrogen liberated. Soils of cold regions should therefore be expected to contain more organic matter and more nitrogen than soils in warmer regions." The decomposition of organic matter under aerobic and anaerobic conditions was taken up also, with the finding that "the considerably slower decomposition of organic matter in peat bogs or in other media where anaerobic conditions prevail is due to the resistance of the lignins to decomposition under these conditions and to the development of a distinct flora of bacteria active in the decomposition processes." A study of the chemical nature of soil humus revealed that this "is very complex in composition and does not consist of a few simple chemical compounds, as ordinarily assumed."

Studies concerned with the relationships between higher plants and soil organisms in the rhizosphere were continued, the results indicating that "the soil population as a whole was far greater and more active in the immediate vicinity of the developing roots than at a distance from the roots. On the root surfaces themselves the organisms reached the greatest development. The results emphasize the idea previously expressed that plant growth is an important factor in keeping microbial development at a high level by supplying organic materials as food for the organisms."

Base exchange studies.—Additional evidence has been accumulated to prove that iron ions replace the aluminum ions. The iron ions become fixed in the soil, whereas the aluminum goes into solution and moves through the soil profile.

In connection with a soil profile survey of the State it is noted that in the Lakewood series true podzols are found. "It is of interest that these podzols seem to have no A_1 horizon."

The availability of nitrogen in nitrate of soda, ammonium sulfate, and dried blood with varying ratios of phosphoric acid and potash—season 1929.—This report adds to the general record of a continuous experiment (E. S. R., 63, p. 318) the data of the season of 1929.

An improved soil sampling tube, H. J. Harper (*Soil Sci., 32 (1931), No. 1, pp. 65–69, pl. 1, figs. 3*).—Finding soil tubes of the customary forms very difficult to remove from the soil because of (1) friction between the expanded portion of the tube and the soil face and (2) suction developed in moist soils when the tube is raised, the author of this contribution from the Oklahoma Experiment Station proposes a design characterized in part by a point tapering to the cutting edge and without an expansion near the point, a core so cut as to be smaller than the inside diameter of the main portion of the tube, and two oppositely placed ribs welded to the outside of the tube, by which, when the tube is revolved after it has been driven to the full depth to be sampled, the hole in which the tube stands is so far enlarged as to give free access of air to the bottom of the hole. The constructional details are fully described and are shown in working drawings accompanying the note.

Wayne County soils, E. A. Norton, R. S. Smith, E. E. DeTurk, F. C. Bauer, and L. H. Smith (*Illinois Sta. Soil Rpt. 49 (1931), pp. 63, pls. 4, figs. 14*).—Wayne County, southeastern Illinois, comprises an area of 453,433 acres of lands ranging in surface features from the level and fairly smooth to the rolling, and drained by the Little Wabash River and by Skillet Fork Creek. The soils are classified under descriptive type names, the 17 types listed including 26.72 per cent of a yellow-gray silt loam on compact medium-plastic clay, 23.97 per cent of a deep gray silt loam, and 15.77 per cent of a gray silt loam on orange-mottled tight clay, with other types of lesser areal importance.

Effect of dilution on the pH of soils treated with various cations, A. T. Perkins and H. H. King (*Soil Sci., 32 (1931), No. 1, pp. 1–8, fig. 1*).—The authors of this contribution from the Kansas Experiment Station saturated samples from six soil types with the hydrogen, ammonium, sodium, potassium, calcium, magnesium, aluminum, and ferric ions, respectively, and determined by means of the quinhydrone electrode the effects of varying degrees of dilution upon the pH values of suspensions of the single-ion saturated soils. Saturation was effected in each case by shaking 20-gm. samples of the soil with 500-cc. portions of a normal solution of a chloride of each cation except hydrogen, which was supplied by a N/20 hydrochloric acid solution.

Curves and numerical data show the pH values as measured at dilution ratios of 1:1, 1:2.5, 1:10, and 1:100. Dilution, in the case of the eastern Kansas mineral soils upon which this work was done, tended to raise the pH

values found, a given degree of dilution having, in general, about the same effect upon the soil reaction regardless of the nature of the adsorbed base. For determinations of soil reaction the most satisfactory ratio was that of 1:2.5. The 1:1 ratio produced, in some cases, "a viscous paste that is hard to bring into intimate contact with the electrode"; and it appeared, on the other hand, that a larger proportion of water "departs further from natural soil conditions," and makes the increase in pH due to dilution more marked.

Exchangeable cations of the soil and the plant.—I, Relation of plant to *certain cations fully saturating the soil exchange capacity*, K. K. GEDROIZ (*Soil Sci.*, *32* (*1931*), *No. 1*, *pp. 51–63*).—A study was made of the growth of oats, and in some cases also of mustard and of buckwheat, in a chernozem soil rich in humus and of which the exchange capacity was in each experiment saturated with one of the cations, hydrogen, ammonium, sodium, potassium, magnesium, calcium, strontium, barium, cadmium, aluminum, ferrous iron and ferric iron, nickel, cobalt, manganese, and copper.

Only in the case of the soil saturated with calcium were the yields the same as those from the original chernozem. The strontium-saturated soil, however, gave yields almost as large as those from the original soil or from that saturated with calcium; and the strontium-saturated soil required no calcium treatment. In the soils saturated with each of the remaining bases the plants showed no growth, either with or without the addition of nitrogen and phosphorus, unless calcium also was added. With nitrogen, phosphorus, and calcium treatment, the hydrogen-saturated soil gave a normal crop, and those saturated with magnesium, aluminum, ferrous or ferric iron, or manganese supported some growth, though less than did the original soil. In the soils saturated with ammonium, sodium, potassium, barium, cadmium, cobalt, nickel, or copper, the plants died without regard to the presence or absence of added calcium carbonate.

"After the practically complete replacement from the soil of exchangeable calcium, the plants require for their development the introduction into the soil of calcium fertilization, without which they do not grow at all; they are unable to utilize the unexchangeable calcium of the soil. After the practically complete replacement from the soil of Mg and K, plants are able to develop and give a more or less normal yield even without the introduction into the soil of magnesium and potassium fertilizers; the plants are able to utilize the unexchangeable magnesium and potassium of the soil."

The nature of soil buffer action, L. D. BAVER (*Jour. Amer. Soc. Agron.*, *23* (*1931*), *No. 8*, *pp. 587–605*, *figs. 6*).—The nature of the colloid remaining the same, soil-buffering power increased with the colloid content; but in soils of the same colloid content differences in the nature of the colloids affected the degree of buffering power conferred upon the soil.

Buffering by organic components of soils was found only in the slightly acid to alkaline range, colloidal organic acids found to be responsible for buffer action at pH ranges above the neutral point.

Of the general cases it is stated that "the nature of soil buffer action is considered solely a function of the nature of the colloidal acids in the soil and primarily dependent upon the inorganic colloidal clay acids. . . . Buffering is due to equilibria between these colloidal acids [organic and inorganic] and their salts as affected by hydrolysis, dissociation, and solubility phenomena."

The total buffer capacity of soils is considered to be determined satisfactorily by the equation:

$$\text{Total buffer capacity} = \Sigma \frac{\Delta B}{\Delta pH} \Big]_{\text{pH of original soil}}^{\text{pH when no exchangeable hydrogen is present}}$$

It is noted that such a summation between the limits stated " gives the buffering at various pH values as well as the total buffer capacity."

The influence of exchangeable ions in soil colloids on bacterial activity and plant growth, N. V. Joshi and A. N. Puri (*India Dept. Agr. Mem., Bact. Ser., 2 (1930), No. 4, pp. 65–81, pl. 1, figs. 2*).—Neither ammonifying nor nitrogen-fixing bacteria were found in soil rendered entirely free from exchangeable bases, cultures of bacteria introduced into such soil failing to survive, while plants placed in the soil did not thrive.

"There is some evidence obtained to show that this effect of the fully unsaturated soil on bacterial activity and plant growth is due to the surface active hydrogen ions present. The bases used to neutralize the unsaturated soil although combined with the mineral complex can serve as nutrient material for both bacteria and plants. Three equivalents (designated H_1, H_2, and H_3) of surface active hydrogen are recognized in a fully unsaturated soil. Bacterial activity and plant growth are checked in such a soil. By neutralization of an equivalent H_1, normal growth can take place. Nitrification, nitrogen fixation, and plant growth are inhibited in soils having a part or the whole of surface active H_1 free. Amonification, however, appears to proceed normally in such soils. There is no evidence to show that exchangeable sodium ions are directly toxic to plants. Their toxicity is most probably due to adverse physical conditions set up by the exchangeable sodium."

A method for the study of Azotobacter and its application to fertility plot soils, I. H. Curie (*Soil Sci., 32 (1931), No. 1, pp. 9–25, pl. 1, figs. 6*).—Report is made of the development at the Ohio Experiment Station of an agar plate method for the determination of the number of Azotobacter colonies in soils, the procedure being described as an adaptation of the Winogradsky silica gel plate method (E. S. R., 54, p. 120).[1] A study of the factors influencing the use of the new method was made, together with an investigation of the Azotobacter flora of the 5-year rotation plats at Wooster, the last-named section of the work having been carried out through the three years 1927–1929.

"In general the Azotobacter population has been much greater in the limed check plats than in the limed plats which receive fertilizer treatments. Additions of nitrate of soda have been followed by greater growth of Azotobacter than additions of either superphosphate or muriate of potash. Additions of manure have resulted in a depression of the Azotobacter flora. It has not been possible to correlate Azotobacter populations and crop yields in the check plats. Azotobacter colonies have not been found in soils which have a reaction more acid than pH 6.0."

Leguminous plants as nitrogen-fixers, O. N. Allen (*Pineapple Quart. [Hawaii. Pineapple Canners' Sta.], 1 (1931), No. 2, pp. 85–88, fig. 1*).—The paper is a semipopular summary, giving a highly condensed review of present knowledge with respect to nitrogen fixation by symbiotic bacteria.

Nitrite production in soils, G. S. Fraps and A. J. Sterges (*Indus. and Engin. Chem., 22 (1930), No. 8, pp. 863, 864; abs. in Texas Sta. Circ. 59 (1930), p. 23*).—Similar work has already been noted (E. S. R., 63, p. 620).

The effect of various sources of organic matter on the properties of soils as determined by physical measurements and plant growth, H. B. Sprague and J. F. Marrero (*Soil Sci., 32 (1931), No. 1, pp. 35–49, figs. 3*).—"A greenhouse experiment was conducted to determine the relative effectiveness of five types of organic matter for improving the physical condition of soil for plant growth. Each type of organic matter was added," in these experiments

[1] Ann. Inst. Pasteur, 40 (1926), pp. 455–520.

of the New Jersey Experiment Stations, "at a light and heavy rate to a sandy soil, a loam, and a clay loam. . . . Under the system of limited watering and adequate fertilization followed, sandy soil was improved for growth of grass by the addition of all types of organic matter. An analysis of the data on physical properties of the soil mixtures indicates that cultivated New Jersey peat and spent mushroom soil are the most satisfactory types of material for sandy soil, followed in order by raw Michigan peat, manure, and peat moss. . . .

"The most effective substitutes for manure were cultivated New Jersey peat and raw Michigan peat. Peat moss was satisfactory only when used at the light rate; and spent mushroom soil was the least effective of the organic materials tested. . . . The addition of organic matter of any type largely prevented the formation of cracks, modified the physical properties of the soil, and increased plant growth. From a consideration of the physical properties of the treated soils and the grass yields produced, fibrous organic materials such as manure and raw Michigan peat seem to be somewhat more suitable amendments than nonfibrous cultivated peat or mushroom soil. The use of peat moss in large quantities with the system of limited watering used seems undesirable because of the slow absorption of water by the dry material and the exceedingly open structure produced. . . .

"Loss on ignition determinations, made at the beginning and end of the experiment for all treated soils, indicate that the organic matter of manure is more rapidly decomposed and lost than that of any other type of organic matter tested. The organic matter of cultivated peat and mushroom soil was more persistent than that of raw peat or peat moss. . . .

"It is clearly shown that other types of organic matter may be substituted satisfactorily for barnyard manure if the nutrient deficiencies are corrected by the addition of fertilizer."

The carbon-organic matter factor in forest soil humus, H. A. Lunt (*Soil Sci., 32 (1931), No. 1, pp. 27–33*).—The Connecticut State Experiment Station contributes a discussion of an experimental investigation into the applicability of the factor $C \times 1.724$ (the assumption that the carbon content of organic matter is 58 per cent) "to peat soils and to the organic horizons of forest soils."

The results and opinions of a number of investigators are cited, and the experimental data obtained in the analysis of 93 soil samples, comprising 14 of litter material, 55 of fermentation layers, and 24 of humification layers, are given. The factor has in each group of data been calculated from the relation,

$$\text{Factor} = \frac{\text{Loss on ignition}}{\text{Per cent } C} \times 100.$$

For the litter material the factor determined from the data was 1.892 ± 0.0057, for the fermentation layers, 1.854 ± 0.0038, and for the humification layers, 1.798 ± 0.0074, average. "The results of this study, together with those of other investigators, indicate quite definitely that the carbon content of carbohydrate-rich materials such as forest litter and peat is less than 58 per cent, and therefore the conversion factor 1.724 is too low. . . .

"In the case of the organic layers of forest soil, the stage of decomposition can not be ignored. For the freshly fallen leaves which have not undergone decomposition to any extent 1.89 is very nearly correct; for the decomposition fermentation or duff layers, 1.85; and for the well-decomposed, structureless humus, 1.80. These factors are equally applicable to all the common forest types such as hardwoods, conifers, and hardwood-conifer mixtures found in New England. When the work of investigators in other parts of the country

is considered it would appear that the factors recommended in the foregoing may be of more or less universal application."

Fiftieth anniversary of the general fertilizer tests, C. F. Noll, F. D. Gardner, and C. J. Irvin (*Pennsylvania Sta. Bul. 264 (1931), pp. 24, figs. 8*).—According to this summary of the findings from the Jordan Soil Fertility Plots (E. S. R., 65, p. 301), phosphoric acid is the first limiting factor for the Hagerstown loam upon which the experiment here noted is located. Phosphates, "alone or in any combination," substantially increased the yields. Potassic and nitrogenous fertilizers, used separately or in combination, had little effect, the nitrogen, least important among the plant foods studied, paying for itself only in the case of 24-lb. applications in the form of ammonium sulfate on the limed plats in the years 1922 to 1930. "Except on the sulfate of ammonia plats, before lime was applied, increasing the nitrogen from 24 to 48 and 72 lbs. per acre has increased the yields, but not sufficiently to justify such high applications." With reference to the effects of potassic fertilizers it is stated in part that "although potash did not increase yields when applied alone, it was used with profit with phosphoric acid, and with nitrogen and phosphoric acid. The amount used, 200 lbs. of muriate of potash on alternate years, is excessive."

With respect to complete fertilizers, manuring, and liming, the findings included the following: "Complete fertilizer, except as soil acidity was a factor, gave as good yields as manure. Where manure was applied at the rates of 6, 8, and 10 tons on alternate years, the greatest return per ton of manure was obtained from the lightest application. For the first 40 years this was $1.80 more per ton from the 6-ton application than from the 10-ton application.

"Both burnt lime and ground limestone gave marked increases in yield over the untreated plats, during the 49 years. At first the effect was negligible; it increased as the experiment continued, and the soil acidity increased on the unlimed plats. While the yields were better with lime than without, lime alone did not maintain fertility. After 40 years without lime, there was an increase from liming with every treatment; the greatest was where sulfate of ammonia had been used."

Care, use, and economic value of farm manure, W. L. Powers and C. V. Ruzek (*Oregon Sta. Circ. 105 (1931) pp. 16 figs. 8*).—Although losses of plant nutrients from barnyard manure as ordinarily handled run as high as 80 per cent, the studies reported indicate that proper handling may reduce this to as low as 20 per cent. Best returns are obtained from light to medium applications of manure and the addition of phosphates. It is further considered that the use of green manures must be increased to keep up the nitrogen and organic matter supply of the soil; and that artificial manures may prove of value in reducing bulky organic material to a form that may be added to soils without widening the nitrogen-carbon ratio.

The fixation, nitrification, and leaching of ammonium sulphate in the soil, F. A. E. Abel (*Pineapple Quart.* [*Hawaii. Pineapple Canners' Sta.*], *1 (1931), No. 2, pp. 88–94, figs. 3*).—Aeration and change of environment appeared to have the initial effect of a stimulation both of ammonification and of nitrification, but after a short time the quantities both of nitric and of ammoniacal nitrogen became comparatively low, it being the author's opinion that a large part of the nitrogen "has been converted or fixed into the form of protein and other organic forms within the bodies of the organisms."

"There is practically no loss of ammonia nitrogen and a comparatively small loss of nitrate nitrogen after the application of the equivalent of 3 in. of rain to a 3-ft. soil section having a moisture content of 30 per cent. There was a slight increase in the nitrate form of nitrogen in the unfertilized soils as the

experiment progressed. The fertilized soils showed a marked increase in nitrates. The temperature did not seem to have any definite influence on the action of the organisms. There was nitrification and ammonification in al the soils regardless of their pH values."

Availability studies on calcium cyanamid and other nitrogenous materials, T. R. Moyer and A. W. Blair (*New Jersey Stas. Rpt. 1930, pp. 318–326*).—These experiments constitute a check upon work reported in 1925 (E. S. R., 54 p. 720), undertaken (1) because the age of the calcium cyanamide used in the original work suggested the possibility that the material might have been partially decomposed and (2) because of the higher percentage of nitrogen in the calcium cyanamide now marketed. The work was carried out in greenhouse pots, in Sassafras loam and in Sassafras sand, with oats, rape, barley, and corn as test crops.

"When the crops grown in the soil are considered alone, calcium cyanamide shows the highest average nitrogen recovery, 61.88 per cent. Nitrate of soda gave a recovery of 60.94 per cent, ammonium sulfate 58.96 per cent, and tankage 25.10 per cent. Calcium cyanamide also gave the highest yield of crops grown in soil. Ammonium sulfate and nitrate of soda followed closely in the order named. Tankage again gave much lower yields.

"Nitrate of soda gave the highest average nitrogen recovery in the sand. The nitrogen recoveries for the different fertilizers were as follows: Nitrate of soda, 61.09 per cent; calcium cyanamide, 55.36 per cent; ammonium sulfate, 50.16 per cent; and tankage, 29.38 per cent. Nitrate of soda also gave the highest average yield in the sand, followed by ammonium sulfate, calcium cyanamide, and tankage respectively.

"The results of this work show a rather high availability for calcium cyanamide and seem to confirm the belief that the sample of cyanamide which Singleton used in his work was old material which had deteriorated on account of standing in the bag for a long time."

Some neglected soil factors in plant growth, A. H. Meyer (*Jour. Amer. Soc. Agron., 23 (1931), No. 8, pp. 606–625, figs. 5*).—With reference to the experimental method of the work noted in this contribution from the University of Wisconsin, it is stated, in part, that "synthetic sand cultures with basal nutrient solutions, containing the usual 10 nutrient elements, were used. The work was carried on in the greenhouse under controlled conditions. . . . Boron, zinc, aluminum, manganese, copper, iodine, and fluorine were the additional elements added to quartz sand cultures besides those in the regular basal solution."

It was observed that "kaolin produced somewhat more benefit than manganese. The addition of manganese with kaolin produced no more benefit than kaolin alone. The results indicate that kaolin has some additional beneficial effect on plant growth aside from supplying manganese. The investigation shows that kaolin, as ordinarily found, is beneficial to plant growth. Impurities in the kaolin, such as manganese, seem to account partially for the benefit. Whether or not the kaolin carries manganese in an especially suitable form for plants is not known. The slightly acidic nature of kaolin may account partially for its beneficial effect. The results of this investigation support those of others that manganese [E. S. R., 54, p. 450] and iodine are essential for the best plant growth."

Inspection of fertilizers, W. L. Adams and F. S. Schlenker (*Rhode Island Sta. Ann. Fert. Circ., 1930, pp. 17*).—Of the analyses of 182 commercial fertilizers and fertilizer materials, "the record . . . shows improvement over that for the past few years." The materials examined were of the usual type, with

the exception of an extremely fine natural product sold as "colloidal phosphate," for which the report states that "until extensive field tests have demonstrated the superiority of this material over other carriers of phosphorus, users will do well to consider the cost as compared with superphosphate and other more common sources of phosphoric acid."

AGRICULTURAL BOTANY

Important western browse plants, W. A. DAYTON (*U. S. Dept. Agr., Misc. Pub. 101 (1931), pp. 214, pls. 12, figs. 45*).—Arranged according to families, genera, and species, descriptions, accompanied by notes as to distribution, properties, usefulness, etc., are given for a large number of plants found growing in the western United States.

Contributions to the family Liliaceae, V. L. CORY (*Texas Sta. Circ. 59 (1930), p. 16*).—A general discussion is presented of the lily family in Texas, with a detailed discussion of the yucca tribe, for which a botanical key is given. The discovery is announced of a second species of Samuela, with a discussion as to occurrence and distribution.

A new Lesquerella from western Texas, V. L. CORY (*Rhodora, 32 (1930), No. 378, p. 110; abs. in Texas Sta. Circ. 59 (1930), p. 18*).—A new species, *L. lepidota*, found in Hudspeth County is described.

A new Salviastrum from the Edwards Plateau of Texas, V. L. CORY (*Rhodora, 32 (1930), No. 376, pp. 89, 90; abs. in Texas Sta. Circ. 59 (1930), p. 17*).—A new species of Salviastrum found in Crockett County and here designated as *S. dolichanthum* is described.

Callusing of cotton stem cuttings, H. E. REA (*Plant Physiol., 5 (1930), No. 4, pp. 575–586, pl. 1; abs. in Texas Sta. Circ. 59 (1930), p. 23*).—The use of soft wood, aqueous solutions of potassium permanganate, and low temperature reduced the percentage of callusing. The storage of cuttings for brief periods, the manner of cutting, and the number of cuttings in the propagator all had little influence on results. The highest percentage of callusing was secured with mature wood, exposure of the base of the cutting above the soil medium, the use of Houston black clay as a rooting medium, and a high temperature (20.2° C.).

GENETICS

Studies in Indian oil-seeds.—V, The inheritance of characters in Indian linseed, F. J. F. SHAW, A. R. KHAN, and M. ALAM (*Indian Jour. Agr. Sci., 1 (1931), No. 1, pp. 1–57, pls. 2*).—A study of inheritance of characters in flax, the fifth paper of this series (E. S. R., 65, p. 530), established that petal color in Indian types of flax depends on the interaction of at least seven hereditary factors, agreeing in general with the investigations of Tammes (E. S. R., 60, p. 824) based on European types of flax. The main difference is in the action of the intensification factor *A*, which, according to the evidence here, is either homozygous in all Indian types or is altogether absent. There was evidence of an additional factor *N* which reduces the intensity of color in petals, but none to split up the factor *B*, and it is also considered that *D* alone (in the absence of *B*) can produce faint blue tinge in the petals if *E* is present. With all other characters, the theories differed materially from those of Tammes.

Crimped petals noted in some types were due to the interaction of the factors *C*, *D*, and *E*, which determine petal color but appear only when all three are present. A fourth factor, *B*, inhibits the formation of crimped petals even

when *C*, *D*, and *E* all are present. In all genotypes with *B* the petal is always noncrimped. The inheritance of color in seed coat evidently depends on the factors *D*, *M*, *G*, and *X*, of which *D* determines flower color as well. *M* in the presence of *D* converts fundamental yellow into fawn, and, if *G* also is present, fawn into brown. In *D*'s absence *M* has no action and yellow is retained. This yellow changes to gray on addition of *G* and becomes brown when *D* is added. *X* acts only as an intensification factor, converting yellow into dark yellow and fawn into dark fawn.

Color in anthers is determined by *B* and *D* in addition to *H* (as suggested by Tammes), for which all the types are homozygous. All types appeared to be homozygous for the factor or factors determining color in the style, and hence in all the crosses style color is determined by the presence or absence of *B*, *C*, *K*, and *E* or *F*, styles being blue only in genotypes possessing these factors. Color in filaments depends on several Mendelian factors besides some of the petal color factors; thus filament color appears only when either of the duplicate factors Z_1 and Z_2 are present and also *B*, *C*, *K*, and *E* or *F*. Apart from Z_1 and Z_2 an inhibitor *T* determines the extent of color. In the presence of *T* the color produced by Z_1 and Z_2 is limited to the distal end of the filament. Color in stigma is determined by *P*, which produces pink only when *B* and *C* are present. If *D* is also present, the stigma color is purple. An inhibitor *I*, when present, turns purple or pink stigma into white.

A cytological demonstration of the location of an interchange between two non-homologous chromosomes of Zea mays, B. McClintock (*Natl. Acad. Sci. Proc., 16 (1930), No. 12, pp. 791–796, figs. 2*).—A case of semisterility in corn, the semisterile-2 of Burnham (E. S. R., 63, p. 218), was found to be associated with a reciprocal translocation (segmental interchange) between the second (9) and third (8) smallest chromosomes. Observations of chromosome synapsis in early meiotic prophases of plants heterozygous for the interchange made it possible to approximate the point of interchange in both chromosomes. The interchange was found to be unequal. Analysis of the chromosome complements in the microspores of plants heterozygous for the interchange indicated that, of the four chromosomes constituting a ring, those with homologous spindle fiber attachment regions can pass to the same pole in anaphase *I* and do so in a considerable number of the sporocytes.

The order of the genes C, Sh, and Wx in Zea mays with reference to a cytologically known point in the chromosome, B. McClintock (*Natl. Acad. Sci. Proc., 17 (1931), No. 8, pp. 485–491, figs. 2*).—Results in a further cytological study at Cornell University gave evidence that the loci for the genes *c*, *sh*, and *wx* lie in that part of the long interchange chromosome (*I*) contributed by chromosome 9 and in the order *wx–sh–c* beginning at the interchange point.

A correlation of cytological and genetical crossing-over in Zea mays, H. B. Creighton and B. McClintock (*Natl. Acad. Sci. Proc., 17 (1931), No. 8, pp. 492–497, figs. 2*).—Studies involving several of the genes and chromosome 9 mentioned above showed that cytological crossing over occurs, and that it is accompanied by the expected types of genetic crossing over. Pairing chromosomes, heteromorphic in two regions, were observed to exchange parts at the same time they exchanged genes assigned to these regions.

Heritable characters in maize, XXXVII–XL (*Jour. Heredity, 22 (1931), Nos. 1, pp. 14–16, fig. 1; 3, pp. 99–102, figs. 2; 4, pp. 116–119, figs. 2; 5, pp. 155–161, figs. 3*).—These contributions continue the series (E. S. R., 65, p. 621).

XXXVII. *Brevis*, H. W. Li.—A semidwarf type of corn noted in 1920 by Hutchison at Cornell University and found to behave as a simple Mendelian character recessive to normal was used in genetic cultures under the name of

brevis (*Bv bv*). The author found brevis to be linked with *pr* and v_2 of the pr–v_2 linkage group, the suggested order of the genes being pr–bv–v_2. The recombination percentage for *bv* and *pr* was 21.7±0.8. It was found that *bv* was inherited independently of *C*, *sh*, *wx*, *g*, *R*, *su*, *Tu*, *B*, *lg*, *Y*, *Pl*, *f*, ts_2, *ra*, *cr*, *A*, and ts_4.

[XXXVIII]. *Male sterile*, W. H. Eyster.—The male sterility in corn described in this contribution from Bucknell University is termed "male sterile$_1$," and according to the tests reported the responsible gene, ms_1, has its locus in chromosome I. A typical male sterile$_1$ tassel is illustrated. The spikelets never have been observed to open so as to expose the anthers. Dissected spikelets were found to contain two flowers, each with three stamens which were naturally in various stages of collapse. Many anthers of male sterile$_1$ plants were dissected without pollen being found.

XXXIX. *Male sterile-3*, W. H. Eyster.—Another male sterility in corn also studied at Bucknell University is produced by a gene ms_3 in chromosome VIII as indicated by its linkage relations with crinkly plant. Male sterile$_3$ tassels approximated in size and branching the normal fertile tassels of the same progenies, but the branches were more slender and inclined to droop. The mature anthers contained microspores and very few or no pollen grains.

XL. *Ragged, a dominant character, linked with A_1, Ts_4, and D_1*, R. A. Brink and P. H. Senn.—The character ragged (*Rg*) described from studies at the Wisconsin Experiment Station derives its name from the tattered appearance of the foliage of corn at maturity. The ragged plants differ from normal corn in a single dominant gene, and in segregating progenies they appeared as vigorous as their normal sibs in early growth. They formed pollen abundantly and *Rg rg* plants, at least, often bore a fair quantity of seed, although at the flowering period *Rg* plants were sharply differentiated from the normal type. *Rg* appeared to be inherited independently of *c*, *sh*, *wx*, gl_1, *f*, *j*, *bt*, and bm_2. Ragged is clearly linked with ts_4 and d_1 and possibly loosely linked with a_1. It appeared probable that the two groups a_1–ts_4 and d_1–pg_2, tentatively recognized as distinct heretofore, are in reality one.

Additional evidence obtained at Cornell University by R. A. Emerson, J. D. J. Hofmeyr, and B. McClintock confirmed the conclusion that a_1–ts_4 and d_1–pg_2 are in the same linkage group and provides the basis for an outline map of the chromosome.

Some problems in the utilization of inbred strains of corn (Zea mays), R. A. Brink (*Amer. Nat.*, *64* (*1930*), *No. 695*, *pp. 525–539*).—Points considered in this contribution from the Wisconsin Experiment Station are the elimination of undesirable genes, a simple method of producing crossed seed, trade-marking crossed seed, a gene affecting crossability, detection of contamination, a criterion of segregation, and physiological isolation by means of translocations.

The use of advanced-generation hybrids as parents of double cross seed corn, T. A. Kiesselbach (*Jour. Amer. Soc. Agron.*, *22* (*1930*), *No. 7*, *pp. 614–626*).—Results obtained during 3 years at the Nebraska Experiment Station indicated that the substitution of advanced-generation single crosses (i. e., continued indefinitely under isolation as open-pollinated hybrids) for F_1 single crosses as parents of F_1 double-cross seed corn may provide a practicable short cut in commercial seed production and is worthy of further trial.

The origin of Spartina townsendii, C. L. Huskins (*Genetica* [*The Hague*], *12* (*1930*), *No. 6*, *pp. 531–538*, *figs. 6*).—Its characteristics and the circumstances of its origin suggest that the grass *S. townsendii* arose from hybridization between *S. alterniflora* and *S. stricta*. The author observed that the somatic chromosome number of *S. townsendii* is 126, of *S. alterniflora* 70, and of *S. stricta*

56. *S. townsendii* evidently originated by chromosome doubling, following on interspecific hybridization.

The effect of temperature on the expression of factors governing rust reaction in a cross between two varieties of Triticum vulgare, J. B. Harrington (*Canad. Jour. Research, 5 (1931), No. 2, pp. 200–207, figs. 3*).—When two random populations of F_2 plants of Marquillo × Marquis wheat were tested at the University of Saskatchewan for the reaction of their F_3 seedling progenies to form 21 of *Puccinia graminis tritici* in the greenhouse at average daily temperatures of 69.7° F. (the warm test) for one population and 60.6° (the cool test) for the other, 10 of 781 families were resistant in the warm test and 5 of 301 were susceptible in the cool test. The results in both cases fitted a 63 : 1 ratio, indicating the operation of three main genetic factors for rust reaction. In both tests Marquis was susceptible and Marquillo resistant. The genetic hypothesis proposed explains the behavior on the basis of the influence of low temperature in curtailing the action of the susceptibility factors *A*, *B*, and *C* carried by Marquis. The results suggested that genetic studies on characters which are easily influenced by environment should be made under controlled conditions, after ascertaining in advance the general effects of different temperatures and other factors upon the hybrid material to be used.

The relationship between endosperm development and morphologic characters in the F_2 generation of a T. dicoccum × T. vulgare cross, J. B. Harrington (*Canad. Jour. Research, 5 (1931), No. 2, pp. 208–218, pl. 1, figs. 5*).—The relationship between the degree of plumpness of F_2 seeds and the type of resulting F_2 plants was studied at the University of Saskatchewan in Vernal emmer (*Triticum dicoccum*) × Marquis wheat (*T. vulgare*). A random sample of F_2 seeds was divided into classes based upon kernel plumpness—plump (class A), slightly shrunken (class B), and shrunken (class C)—which included 55.5, 41, and 3.5 per cent of seeds, respectively. The field emergence of F_2 plants was 64, 58, and 36 per cent, respectively. Comparing the F_2 populations for all 13 morphological characters combined, class A was more *dicoccum*-like than class B, which in turn was much more *dicoccum*-like than class C. The proportion of *vulgare*-like character was 16, 20, and 32 per cent for the classes A, B, and C, respectively, and when the character of the individual plants was considered the respective ratios of *dicoccum*-like to *vulgare*-like were 12.1 : 1, 5.3 : 1, and 2.2 : 1. The *vulgare*-like plants of classes A and B were less *vulgare*-like than those of class C, although there were present in classes A and B some plants fully as *vulgare*-like as any in class C. The results were held to indicate that in an interspecific wheat cross the breeder should pay special attention to the shrunken F_2 seeds if nursery space is very limited and seed is plentiful, whereas if space is adequate for a large population such care does not seem warranted.

Breeding experiments with sheep and swine, B. L. Warwick (*Ohio Sta. Bul. 480 (1931), pp. 37, figs. 5*).—This consists chiefly of more complete accounts of investigations previously noted (E. S. R., 63, p. 25). The studies are concerned with the inheritance of black in Shropshire and Merino sheep, chalk-face in Merinos, entropion or turned-in eyelids in lambs, cryptorchids or ridgelings in sheep, and of black, scrotal hernia, and a high-stepping character in swine.

Inheritance of body-weight in domestic fowl, N. F. Waters (*Rhode Island Sta. Bul. 228 (1931), pp. 105, figs. 58*).—Following a foreword by W. E. Castle, the results are presented of a study of the inheritance of body weight in a cross of Brahma and White Leghorn fowls, involving 2,966 birds produced over a period of 10 years. The weight at 10 months of age was employed as the measure of mature weight. The 10-months weight of females multiplied by

1.28 was found to be equivalent to the 10-months weight of males. The average male equivalent weight of the Leghorns was 2,064±6.12 gm., ranging from 1,300 to 2,900 gm., while the average male equivalent weights of the Brahmas was 3,940±25.18 gm., ranging from 3,200 to 5,000 gm.

The results showed that the F_1 hybrids from reciprocal matings were intermediate in weight between the two parent breeds, and that their variability was no greater than that of either parent breed. The F_2 hybrids were also intermediate, but they showed greater variability than the F_1 generation. F_2 individuals, regardless of their weight, produced essentially similar F_3 populations. There were, however, differences in the distribution of the F_3 populations produced by F_2 parents selected for small, intermediate, and large size.

It appeared from the analysis that the weight differences in the parent breeds were mainly due to two pairs of genetic factors which are individually equal but cumulative in their effects. Many other influencing genes also appeared to operate.

The weights at hatching of Brahmas, Leghorns, and hybrids was nearly the same, the small differences being related to the size of the eggs from which the chicks were hatched. The growth velocity of the Brahmas was greater than that of the Leghorns after the third week. The growth curves of the F_1 and F_2 hybrids followed the growth curves of the Brahmas up to about seven months, after which they were intermediate between the growth curves of the Brahmas and Leghorns. There was some evidence of an accelerated growth rate in the F_1 and F_2 hybrids during the first three or four months after hatching, but the growth curves of the parents and the F_1 and F_2 hybrids did not show variability that could be attributed to genetic differences until growth was nearly completed. The early growth acceleration was attributed to heterosis, but at 10 months there were no apparent effects of heterosis. The growth of backcross and F_3 and F_4 selections indicated that hybrid vigor decreased as homozygosis was approached.

FIELD CROPS

The "coincidence" as major factor in agriculture, T. D. Jarvis (*Sci. Agr., 11 (1931), No. 11, pp. 760–770, 771–774, pl. 1, figs. 8*).—A discussion of the coincidence or combination of interactive environmental factors under which crops find optimum environment and produce maximum yields, illustrated by record production of potatoes in British Columbia, Ontario, and Colorado.

Sampling technique as applied to irrigated pasture in regard to botanical composition and carrying capacity under different grazing systems, A. Morgan and E. T. Beruldsen (*Jour. Dept. Agr. Victoria, 29 (1931), No. 1, pp. 36–45, figs. 7*).—The effect on the productivity of an irrigated pasture of a rotational v. a nonrotational system of grazing, according to methods developed at the Werribee State Research Farm, can be determined by reducing to a standard moisture percentage the herbage cut from 25 areas of 8 square links arranged in a definite pattern over each of three ½-acre plats selected at random at regular intervals throughout the year. The effect on the botanical composition is determined in periodical surveys by percentage estimation on 35 samples, each 4 square links in area, arranged in a definite pattern over each ½-acre plat.

An extension of the sampling technic shows the quantity of herbage consumed per sheep per day under the two systems. In addition to 25 samples of grass cut before grazing and recut after grazing, 35 samples are cut on each ½ acre after grazing. Then the quantity consumed equals that present before grazing less that present afterwards plus the amount of growth during

grazing. Comparison of the percentages of major species on the ½-acre plats before and after grazing permits the species preferences of the sheep under the two systems to be deduced, compared, and correlated with factors external to the pasture.

Water-supplying power of the soil under different species of grass and with different rates of water application, F. A. WELTON and J. D. WILSON (*Plant Physiol., 6 (1931), No. 3, pp. 485–493, figs. 5*).—Kentucky bluegrass, Chewing's fescue, and Washington bent were grown at the Ohio Experiment Station in 1930 on plats receiving no water besides rain, and on plats receiving 50, 100, and 200 per cent more water than normal rainfall. Determinations of soil moisture in June, July, and August were made under severe drought conditions. The soil moisture on the checks was below the 100 mg. critical value and the grasses were brown and dry, whereas the other plats usually well exceeded the 500 mg. value and yields indicated that more than 1.5 N of water was not needed for good top growth of lawn grasses. The greater water-supplying power of the soil under the fescue suggested that this narrow-leaved grass demands less available soil moisture than the two broader-leaved forms. This observation and the fact that it enters drought with a greater reserve of soil moisture suggest possible reasons why this species can survive drought periods better than many other forms such as the bents and bluegrasses.

[Field crops work in Nebraska, 1930] (*Nebraska Sta. Rpt. [1930], pp. 14–18, 29, 30, 35–37, 42, 43, 44–46, 47, 48*).—These pages report the continuation at the station and substations of agronomic experiments (E. S. R., 63, p. 627), including variety trials with oats, barley, and spring wheat (E. S. R., 65, p. 432), winter wheat, corn, alfalfa, sorgo, and miscellaneous forage crops; breeding work with corn, winter wheat, oats, and potatoes; seed treatment studies with corn, wheat, and potatoes; fertilizer trials with wheat, corn, oats, and alfalfa; cultivation (including planting) tests with corn, wheat, oats, and barley; meadow improvement work; and crop rotations.

Some of the selfed lines and hybrids of corn seemed to have a rather wide adaptation. Although the hybrids outyielded standard varieties, it was clearly demonstrated that many hybrids are inferior to ordinary farm selected corn. The use of advanced generation hybrids to make double crosses is noted on p. 819.

In 8 years' comparison of methods for preparing the seed bed for corn, plowing and listing gave about equal results, fall plowing was distinctly unfavorable, and 7-in. plowing surpassed shallow plowing. The use of furrow openers on plowed ground did not increase the yield. There was additional evidence that the major effect of cultivation is to prevent weed growth, although suppressing weeds by scraping gave 5 per cent less in yield than did four cultivations. Wide latitude is permissible as to shallow, close, or wide cultivation, provided the weeds are destroyed equally well. Fewer than three cultivations were not enough, yet frequent and prolonged cultivation was of no advantage.

Various studies indicated that the best type of plat for comparative tests of corn varieties and hybrids was one containing 4 rows 12 hills long. Yields are based on the two middle rows and the plats replicated five times, while the corn is planted at double rate and thinned uniformly to 3 plants per hill.

Early planting of oats and spring wheat was decidedly of advantage, while barley endured late planting better than did either of these spring grains. Indications were that the quantity of seed sown per acre may range rather widely without any material influence on yield. Early seed bed preparation

for winter wheat to reduce volunteer grain and weeds continued to be an important factor in high yields. Early tillage at North Platte to control weeds after harvest increased the 10-year average yield of winter wheat more than 30 per cent and of barley, oats, and corn about 25 per cent.

That protein content is a predominating quality factor in Nebraska wheats, as elsewhere, when quality is considered from the viewpoint of prevailing methods used in modern flour and bread production, was again confirmed. It was also emphasized that as compared with hard bread wheat grown in other localities and on the basis of protein content Nebraska wheat is in no way inferior in quality.

The annual data in fertilizer trials with cereals indicated that in some seasons the availability of phosphorous is low and the possibilities for profit from superphosphate, especially with wheat, are good and that there are seasons when the availability of nitrogen is low. At the station wheat responded significantly to phosphorus in 5 of 9 years and oats in 3 years. Oats responded significantly to nitrogen in 5 years. In no year did any crop respond significantly to potassium or corn to any commercial fertilizer.

Rotations at Scottsbluff containing either alfalfa or sweetclover or receiving applications of barnyard manure continued to give uniformly higher yields than those neither including legumes nor receiving applications of manure. In cropping systems omitting manure and alfalfa the yields of all crops showed a decline.

Further evidence was had that good seed potatoes could be produced in central and eastern Nebraska. As to number and depth of stolons and tubers, length of stolons, shape of tubers, and scab prevalence, shallow planting seemed more satisfactory than deep planting and high ridging. Indications were that keeping seed potatoes in cold storage is desirable, the most benefit coming from cold storage after March 1. Removing sprouts in early June after cellar storage resulted in from 20 to 30 per cent increase in yield, but this was not as satisfactory as cold storage. Studies on the effects of ethylene chlorohydrin treatment and maturity on dormancy are noted on p. 827.

In a series of studies made with Triumph potatoes, exposure of tangential cuts on immature tubers to direct sunlight for 6 hours resulted in the desiccation of many surface cells, with a significant slowing up in suberization and cork formation. Cutting out some light rays was beneficial in hastening healing. Treating wounds with hot formaldehyde within 2 days after injury retarded suberization and cork formation, but if suberization had begun already when the wound was treated, no retarding effect appeared. Cracks and wounds in the tubers did not heal as rapidly as tangential cuts. Exposure of the cracks to sunlight during the first 6 hours retarded healing during the first 2 weeks. When lots of seed potatoes were treated with hot formaldehyde at intervals from 1 hour after harvesting to the day of planting, undesirable effects as measured by emergence, stand, and yield were apparent only with lots given extreme treatment.

While the superior winter hardiness and high yield of Grimm and Cossack alfalfa were fully confirmed, it appeared (E. S. R., 63, p. 344) that they are relatively susceptible to alfalfa wilt and so are less desirable than hardy northern grown common strains in sections where this disease may be serious, especially on bottom land soils. Depletion of subsoil moisture on the tableland (E. S. R., 61, p. 518) seemed to cause rapid decline in yields after about 5 years of cropping. Inadequate subsoil moisture apparently limited yields in fertilizer plats.

Seeding tame grasses and clover on subirrigated meadows at Valentine again demonstrated the inadvisability of planting where water is further down than

3 ft. Seeding on marginal land often is unsatisfactory because of annual fluctuation of the water table.

[**Agronomic experiments in New Jersey**], J. G. LIPMAN and H. B. SPRAGUE (*New Jersey Stas. Rpt. 1930, pp. 20-23, 299-307*).—Continued experiments with field crops (E. S. R., 63, p. 331) included improvement work with corn, wheat, rye, oats, barley, alfalfa, red clover, and Jerusalem-artichoke; variety trials with these crops, potatoes, seed flax, and alfalfa, clover, and timothy (E. S. R., 65, p. 31); planting tests with wheat and barley; comparisons of green manure crops for corn and emergency hay crops; fertilizer tests with Jerusalem-artichoke and pasture; and studies with turf grasses (E. S. R., 63, p. 225).

Experiments in cooperation with farmers indicated that much of the corn currently grown in New Jersey was poorly adapted, either because of recent introduction of seed or selection of plant and ear types not associated with productivity. Indications in correlation studies were that chlorophyll concentration and leaf area of the corn plant are major factors in determining the yields of grain and stover. In the dry year of 1929 corn made highest grain yields after the green manures, winter vetch, red clover, and yellow sweetclover and the most stover after alsike clover, red clover, and winter vetch.

Spacing studies showed that wide variations in spacing of barley could occur without influencing yield of grain or straw, provided the average quantity of seed per acre equaled the optimum. This was explained by the ability of the root systems of plants from thickly sown sections to extend into the soil of adjacent thinly seeded areas, thus permitting complete utilization of the soil horizons penetrated by the root system. Late planting of winter wheat could partly be compensated for by heavier rates up to 8 pk., while more than 5 to 6 pk. per acre did not give yield increases when planted at the usual time. Two years' results suggested that seed flax might be a profitable cash crop.

Comparisons of annual hay crops showed the better soybean varieties capable of yielding from 2 to 3 tons per acre of cured hay equaling alfalfa in chemical composition. Sudan grass-soybean mixtures could compete with weeds more successfully than soybeans alone, and forage yields were higher. In chemical composition the mixture was much superior to grass hay but was inferior to legume hay. Soybeans were more productive than cowpeas and millet as emergency hay crops. Soybeans should be sown for hay in the station latitude about the last week in May and harvested before seeds begin to develop in order to prevent difficulty in curing, this stage being reached about September 1 with the Wilson-5 and Virginia varieties.

Pasture tests begun in April, 1929, on three soil types showed the effectiveness of lime, manure, and phosphates for improving herbage yields and for increasing the percentage of desirable forage plants. Periodic mowing to prevent grasses and weeds from producing seed and flower heads improved the quality and quantity of herbage for grazing.

In tests of the physical value of organic materials mixed with soils of different textures and cropped to grass, a tilled peat from New Jersey and spent mushroom soil gave most satisfactory results on sandy soil, whereas fibrous or coarse types of organic matter were less valuable than nonfibrous materials and produced inferior results unless applied sparingly. On clay loams the fibrous materials were the most effective in improving soil structure. In general indications were that peat and peaty materials may satisfactorily replace manure to improve the physical condition of soils, the choice of material depending on the nature of the soil and the type of crop.

[Field crops work in Tennessee], C. A. Mooers, O. W. Dynes, H. P. Ogden, L. S. Mayer, S. H. Essary, L. R. Neel, and B. P. Hazlewood (*Tennessee Sta. Rpt. 1930, pp. 10–19, 23–25, 45, 47, 49*).—Experiments at the station and substations (E. S. R., 64, p. 335) reported as carried on in a season of record general drought comprised variety tests with corn, cotton, sweetpotatoes, lespedeza, soybeans, and kidney beans; breeding work with corn in cooperation with the U. S. Department of Agriculture, and with barley, cotton, red clover, and Austrian winter peas; seed certification work; and pasture studies.

[Reports of the division of field husbandry, 1928, 1929, and 1930], E. S. Hopkins (*Canada Expt. Farms, Div. Field Husb. Rpts. 1928, pp. 48, figs. 12; 1929, pp. 59, figs. 12; 1930, pp. 47, figs. 14*).—Agronomic work reported on comprised crop rotations and tillage and cultural experiments involving various field crops, manuring and fertilizer trials, recording of production costs, paper mulch tests, weed-control studies, trials of the combine in eastern Canada, soil moisture experiments in the prairie provinces, range land investigations, and observations on weather conditions at the Central Experimental Farm at Ottawa.

Effects of high soil moisture and lack of soil aeration upon fruiting behavior of young cotton plants, W. B. Albert and G. M. Armstrong (*Plant Physiol., 6 (1931), No. 3, pp. 585–591, fig. 1*).—Experiments at the South Carolina Experiment Station, noted earlier (E. S. R., 62, p. 630) are reported in more detail. Cotton grown with high soil moisture conditions shed a larger percentage of fruit buds than plants under soil moisture conditions nearer optimum. Such increase in shedding was associated with the lower percentage of oxygen and higher percentage of carbon dioxide observed in flooded plats in contrast to unflooded plats.

On the effect of ginning on the staple-length of cotton fibres, and also on the reliability of random sampling, K. R. Sen (*Agr. and Livestock in India, 1 (1931), No. 2, pp. 142–150, fig. 1*).—Comparisons of the fiber lengths of ginned and hand-separated samples of a pure strain of Cambodia cotton showed that ginning produced some breakage among fibers about 1 in. and longer, resulting in smaller percentages of fibers exceeding 1 in. and increasing those of shorter lengths. There was a possibility of a considerable number of fibers longer than 1 in. breaking during hand separation. The effect of ginning on the average length for an individual sample was so slight as to be within the limits of experimental error. Random selection of a sample from a ginned bulk of cotton appeared sufficiently representative as to average length.

[Reports of the division of economic fiber production, 1928, 1929, and 1930], R. J. Hutchinson (*Canada Expt. Farms, Div. Econ. Fibre Prod. Rpts. 1928–1929, pp. 28, figs. 2; 1930, pp. 18, fig. 1*).—Variety, seed source, seeding, fertilizer, harvesting, and retting experiments with flax and hemp at Ottawa and other experimental centers in Canada are reviewed for the years indicated.

Spring tillering of fall-sown oats, C. K. McClelland (*Jour. Amer. Soc. Agron., 23 (1931), No. 4, pp. 299–303*).—Fall-sown oats, transplanted at the Arkansas Experiment Station to pots in the greenhouse in the spring with 1, 2, or 3 plants per pot, averaged about 3 tillers per plant, but with 4 or 5 plants per pot new tillers occurred on only 30 per cent of the plants. Crowding restricted the formation of new tillers. When set out in separate blocks in the open field about March 1, 1-tillered plants could not put on as many tillers as the 2- to 6-tillered plants. Plants with 5 and 6 tillers, however, averaged high in new tillers and had the highest average number of heads per plant at harvest.

With 3-tillered plants set out in several spacings, the number of new tillers and of heads of grain rose with each increase in space. Undisturbed plants having 1, 2, or 3 tillers produced fewer new tillers per plant and averaged much fewer heads per plant at harvest than did transplanted plants. The results indicated that the spring tillers have a definite value in seed production, which value varies with the number of original tillers on the plant and the thinness of the stand.

Effects of various plant foods on growth activities and development of oats, C. K. McClelland (*Jour. Amer. Soc. Agron., 23 (1931), No. 4, pp. 304–311*).—In connection with the above study on the spring tillering of oats different fertilization was given various pots and rows to which the oats were transplanted.

Phosphorus seemed most beneficial in increasing the number of tillers, heads at harvest, and spikelets per head, yield, and the size of seed of oats. It also resulted in early tillering and growth and a quick shading of the ground, although the early lead of plants given phosphorus was not maintained entirely and the difference in appearance at harvest was much less marked. Nitrogen closely followed phosphorus in effect upon tillering, number of heads at harvest and of spikelets per head, and of yield. Potassium had no influence, unless one of restriction, on number of tillers and number of heads per plant or per row at harvest and upon yield, but in combination with nitrogen and phosphorus it increased size of seed. The nitrogen and phosphorus, however, exerted better influence on weights per bushel and upon general growth and development. Usually high and significant correlations were found between length of heads and number of spikelets per head.

Austrian winter field peas in Oregon, H. A. Schoth (*Oregon Sta. Bul. 286 (1931), pp. 23, figs. 3*).—The characteristics and soil and climatic adaptations of this legume are described, and the uses of the crop for forage and green manure and as a seed crop and its cultural needs are indicated extensively from experiments in cooperation with the U. S. Department of Agriculture. Marketing practices, fungus diseases, and insect pests are discussed briefly.

Considered better adapted to western Oregon, where it is winter hardy, the pea thrives with a well prepared seed bed and October seedings drilled at the acre rate of 75 lbs. alone or of 60 lbs. with from 3 to 5 pk. of small grain, and requires inoculation. It fits well into short time rotations and responds readily to land plaster on soils where vetch, clover, or alfalfa benefit from such treatment.

Proceedings of the seventeenth annual meeting of The Potato Association of America (*Potato Assoc. Amer. Proc., 17 (1930), pp. 178, figs. 2*).—The seventeenth annual meeting of the association, held in Cleveland, Ohio, on December 30 and 31, 1930, is reported on, and the activities of the organization and of its committees in 1930 are summarized. Papers presented include several abstracted below, together with the following: Greening Seed Potatoes Under Various Conditions, by J. Bushnell (pp. 5–11) (E. S. R., 65, p. 433); Experiments with Dust Treatments and Cut Potato Seed, by E. E. Clayton (pp. 24–27); Potato Spraying and Dusting Experiments in New Brunswick, 1924–1930, by D. J. McLeod (pp. 28–36); A Discusion of Second Growth, by C. L. Fitch (pp. 37–41); High-Analysis Fertilizers, by F. E. Bear (pp. 45–50); The Successful Growing of Potatoes in Dry Weather, by E. B. Tussing (pp. 51–53); Potato Prices and Acreage Stability, by L. H. Bean (pp. 53–61); The Relation of Soil Conditions to the Development of Potato Scab, by W. H. Martin (pp. 62–73); Transmission of Spindle Tuber of Potatoes through the Usual Commercial Practices, by L. O. Gratz (pp. 73–82); Virus Diseases of the Potato, by D. Folsom (pp. 83–101); Sun-Scald Injury of Potatoes as In-

fluenced by Solar and Sky Radiation and Storage Temperatures, by W. M. Peacock, R. C. Wright, and T. M. Whiteman (pp. 102–108); Differences in the Cooking Quality of Potatoes Due to Storage Temperatures, by W. M. Peacock, R. C. Wright, T. M. Whiteman, and E. Fuller (pp. 109–116); Recent Contributions to Potato Breeding and Related Subjects, by F. A. Krantz and R. M. Bailey (pp. 124–128); A Numbering and Recording System for Potato Breeding, by R. M. Bailey and F. A. Krantz (pp. 128–131); Some Distinct Tuber-Line Strains in Triumph Potatoes; A Preliminary Report, by H. O. Werner (pp. 132, 134); Comparison of "Healthy" Green Mountain Strains and Tuber Lines in Maine, by D. Folsom (pp. 134–140); A Preliminary Report of Regional Strain Testing of Potatoes in New York, by J. D. Hartman and E. V. Hardenburg (pp. 145–150); Report of the Chairman of the Research Committee, by W. Stuart (pp. 150–161); and Report of the Seed Potato Certification Committee, by W. H. Martin (pp. 162–174).

The origin by mutation of some American potato varieties, C. F. Clark (*Potato Assoc. Amer. Proc., 17 (1930), pp. 117–124*).—Employing methods of Asseyeva (E. S. R., 58, p. 423), consisting in removing from the eyes of the seed pieces the outer layers of tissue, which according to the periclinal conception of tuber skin color mutations in the potato is the mutant tissue, and allowing the sprouts from which the test plants were grown to develop from the deeper layers, the original unchanged tissue, the author obtained results which indicated that Noroton Beauty is a mutant from Triumph, Blue Victor and Peoples mutants from Peerless, and Russet Rural a mutant from Rural New Yorker No. 2. Tests with Peerless and Russet Burbank did not furnish evidence of their origin by mutation.

The effect of green sprouting potato seed tubers on earliness and yield, K. C. Westover (*Potato Assoc. Amer. Proc., 17 (1930), pp. 12–23*).—Plants grown from green sprouted tubers in West Virginia Experiment Station studies came up quicker and made more rapid early growth than normal or sprouted seed, whereas the normal seed produced the greater total yield and yield of grade No. 1 tubers. Green sprouting evidently caused quicker emergence but did not increase yields.

The effect of maturity and the ethylene chlorohydrin seed treatment on the dormancy of Triumph potatoes, H. O. Werner (*Nebraska Sta. Research Bul. 57 (1931), pp. 39, figs. 11*).—Experiments were made to determine with Triumph potatoes the significance of tuber maturity in relation to the duration of the dormant period and the response to chemical treatments, principally ethylene chlorohydrin, for inducing growth in dormant tubers, the effects of various methods of handling seed potatoes on sprout growth, and the best method of using the ethylene chlorohydrin seed treatment. The ethylene chlorohydrin treatment consisted of short-time dipping of cut sets in a 5 per cent solution and draining, followed by 24 hours in an air-tight chamber.

Emergence from the dormant period was found to be gradual and not to occur abruptly. As the time after harvesting was prolonged, tubers sprouted more promptly when planted and the sprouts and number of sprouting eyes per set increased. In field tests planted during September in Bermuda the yield increases from seed treated with ethylene chlorohydrin ranged from 17.5 to 62 per cent, being indicative of the relative advances in sprouting induced by treatment. The most mature potatoes made the most prompt response to treatment. With Nebraska-grown potatoes approaching the end of dormancy and planted in January at Hastings, Fla., ethylene chlorohydrin did not appear to hasten emergence or increase yields, although producing more stems per plant.

Tubers harvested when immature ripened in storage more quickly than potatoes allowed to remain on the vines from 1 to 3 months longer. When vines were cut early and potatoes left in the field until October the tubers produced sprouted more promptly and vigorously than late harvested stock but not so quickly as early harvested potatoes. Potatoes immature due to late planting responded more slowly than mature tubers early in the season but sometimes more quickly by the end of the season. Tubers immature because of late planting of stocks sprouted more slowly than those immature from early harvest, but the former produced more sprouts when both lots were stored the same length of time. Potatoes stored in the cellar at temperatures above 45° F. generally sprouted sooner than those held in cold storage, i. e., below 42°.

The ethylene chlorohydrin treatment used on tubers from lots of seed of various degrees of maturity and from monthly plantings during the winter induced prompt sprout growth in all potatoes that had not completed dormancy, but with advance toward the end of the respective dormant periods the response to treatment declined. The greatest growth, as measured by growth rapidity and number of sprouts, was made by potatoes that were most mature when treated, although the greatest stimulation compared with the untreated check was with the most immature tubers. The treatment increased the numbers of sprouting eyes and of sprouts per set. The increase was very great early in dormancy but so diminished that it was relatively small when the dormant period ended. This inhibition of apical dominance seemed to cause the reduction in number of very early sprouts from potatoes treated when dormancy was nearly ended. A given lot of potatoes usually produced more early growth when treated and planted October 15 than did untreated tubers of the same lot planted either then or later, prior to January or February.

Treatment with ethylene chlorohydrin was found the most effective method of initiating early and general sprouting in dormant tubers. Sodium thiocyanate treatment (5 per cent for 1 hour) gave fairly good results. Removal of the periderm had little effect as compared with these chemical treatments. The effectiveness of the ethylene chlorohydrin, as measured by sprout growth, appeared to be enhanced by application not later than 48 hours and preferably not beyond 24 hours after cutting the tubers, planting in soil or some other medium with a high moisture-holding capacity, in contrast with sand, and by using large sets.

Cultivation experiments with potatoes on Long Island, H. C. Thompson and P. H. Wessels (*Potato Assoc. Amer. Proc., 17 (1930), pp. 41–44*).—Potatoes grown on sassafras silt loam on the Long Island, N. Y., Vegetable Research Farm averaged for the period 1927–1930 when cultivated all season 197.5 bu. per acre, cultivated half the season 200.6, scraped 211.8, and with weeds allowed to grow 70.2 bu. It appeared that if cultivation enough for weed control is provided the soil mulch on silt loams and lighter soils need not be given much consideration.

Studies on sugar cane roots, T. C. Ryker and C. W. Edgerton (*Louisiana Stas. Bul. 223 (1931), pp. 36, figs. 9*).—Significant features of the structure, development, and behavior of sugarcane roots are described for their bearing on field operations of growers.

The roots developing from the seed pieces maintained the young shoots until they developed their own roots, and shoots from stubble cane depended on the old stubble roots. Loose and well aerated soil favored root development. Root box studies revealed that the first primary roots which formed on the young shoots grew downward in the soil. Later secondary and tertiary roots

developed which grew out into the surface layers. The development in the boxes did not differ materially from that in the field. Field excavations showed that, although roots extend deeper than 4 ft., usually from 85 to 95 per cent are in the upper 14 in. of soil. The growth rate of shoots and roots appeared to vary from year to year. In 1929 roots reached the middle of the row between May 22 and 30, but not by June 5 in 1931. In 1929 the roots were nearly twice as long as the height of shoots but were somewhat shorter in 1930 and 1931.

Sugarcane varieties currently grown in Louisiana showed an average germination between 20 and 30 per cent during the period 1928–1931. The minimum temperature for growth was observed to vary with different varieties, being about 54° F. for P. O. J. 213 and P. O. J. 36 and about 57.5° for Co. 281. At such temperatures growth is very slow and the roots decay readily. Deterioration of stubble appeared to be closely associated with the growth of roots and shoots in the fall. Varieties like Co. 281, which start growth slowly in the fall and require a higher temperature for growth, do not deteriorate so severely as some of the others.

The importance of keeping the roots in rapid growth is emphasized. Injury to the seed piece roots and old roots on stubble and cutting of feeding roots in the upper layers during cultivation should be prevented so far as possible. To maintain a loose aerated soil, deep cultivation evidently should precede development of roots in the upper soil layers.

HORTICULTURE

[Horticulture at the Nebraska Station] (*Nebraska Sta. Rpt. [1930], pp. 20–22*).—Observations on young apple trees pruned heavily and lightly at the time of planting with little or no subsequent treatment showed both lots in their fourth year to be making about the same annual increase in diameter, the lightly pruned trees simply retaining the advantage gained in the initial year. Among strawberries under test Dr. Burrill and Premier were outstanding. Sapa and Opata were the only plums to bear a good crop in 1930. Cultivation gave better results with grapes, both in total yield and in weight of clusters, than did mulching. Cultivation plus ammonium sulfate gave the highest yields of grapes. The cultivated plats contained a higher percentage of nitrates than did the mulched plats. The scraped plats averaged about as low in available nitrogen as the mulched areas. Nitrate fertilizers greatly increased the available nitrogen in the cultivated plat but not in the permanently mulched plats. Ammonium sulfate and nitrate of soda applied to Concord and Moore Early grapes had no affect on the germination of the pollen.

Cultural tests with vegetables indicated that irrigation is the most practical means of increasing yields. Straw mulching was next, but paper mulch beyond hastening early maturity proved inferior to tillage and decidedly inferior to straw mulch. Shallow tillage, especially in nonirrigated soils, was superior to moderately deep tillage, and irrigation was of most value on tilled soils. Nitrate of soda was sometimes beneficial in connection with straw mulch. Apple trees grown on Virginia Crab roots continued to lead in respect to growth.

[Horticultural science at the New Jersey Stations] (*New Jersey Stas. Rpt. 1930, pp. 40, 41*).—Experiments conducted in cooperation with S. H. Eckerson of the Boyce Thompson Institute showed that the amount of reducase in Biloxi soybeans may be regulated by the length of day. With an 8-hour exposure practically no reducase was found, but with a 12-hour exposure much was present. In the tomato the same trends were observed, though not so sharply defined. Practically no reducase was found in the

roots of asparagus, but in the fine fibrous roots where nitrate reduction has been shown to take place almost exclusively there was found abundant reducase. The maximum reducase is not necessarily associated with vigorous growth, since nonvegetative yellow nitrate-deficient tomato plants were very high in this material.

Observations on the cranberry plant showed an abundant external mycorrhiza on the roots, with an internal mycelium both inter- and intracellular keeping pace with the vegetative development of the plants. This mycelium contained glycogen, particularly in the older portions, whereas the principal carbohydrate in the cranberry itself was starch, which occurs abundantly not only in the stem but in the thick persistent leaves. Callose stains revealed the younger mycelium, whereas there was considerable pectic material in the walls of the older mycelium.

[Horticulture at the Tennessee Station], S. H. ESSARY, J. A. MCCLINTOCK, H. P. OGDEN, and B. P. HAZLEWOOD (*Tennessee Sta. Rpt. 1930, pp. 26–28, 40, 41, 45, 46, 50, 51*).—A test was made of 10 varieties of tomatoes, 4 pink and 6 red, with the general observation that the red varieties were superior in yield. Considerable differences were noted in varietal resistance to certain diseases, Gulf State Market being susceptible to wilt and Tennessee Pink to mosaic disease. Very little difference was noted in the resistance to leaf spot, the control of which is said to rest in sanitation and treatment with fungicides. Clean seed beds obtained by disinfecting with acetic acid or by steam sterilization insured clean plants for the field. Comparing Bordeaux mixture spray with a proprietary copper dust, the results favored the latter, particularly in respect to total yields. Records taken on tomato plants produced from seed sown February 1, March 1, and April 1 favored the later sowings in respect to yield, but for early market early planting is deemed necessary.

Storage studies with Aroma strawberry seedlings developed by the station showed some to surpass Aroma in keeping qualities. Further selections were made on the basis of these tests, and breeding was continued. Seedling raspberries obtained by crossing Van Fleet with standard varieties suffered severely from the drought and displayed great variation in habits of growth. Rhubarb seedlings distributed by the station in 1930 gave promise of being more resistant to crown rot than were commercial varieties. Favorable results were secured in the growing of pyrethrum, the flowers having a desirable content of active substance.

Strawberry investigations at the Mericourt Substation included a test of nitrate of soda, results of which were entirely negative. As regards depth of cultivation, the deepest tillage gave the best results. Variety tests of raspberries, strawberries, and rhubarb are briefly discussed. The Aroma strawberry seedlings from the main station were found promising.

Excellent seedlings for fruit stock production were grown at the West Tennessee Substation. Miscellaneous notes are presented on the results of tests with various fruits and vegetables.

[Olericultural studies at the New Jersey Stations], L. G. SCHERMERHORN and W. R. ROBBINS (*New Jersey Stas. Rpt. 1930, pp. 41, 229–234, figs. 2*).—Asparagus grown in sand cultures in the greenhouse made the most rapid growth and greatest total linear extension in the December–February period (short days) when supplied with a high proportionate concentration of potassium sulfate and a low concentration of calcium nitrate and magnesium phosphate. In the March–June period (long days) a higher proportionate concentration of calcium nitrate, a lower concentration of potassium sulfate and magnesium phosphate gave better results, indicating that the nutrient supply should be adjusted according to the carbohydrates supplied by photosynthesis.

Ammonium sulfate applied to asparagus seedlings in sand cultures resulted in sufficient growth to indicate that this species can absorb and assimilate ammonium nitrogen. A small trace of nitrate nitrogen was found in the cultures. No injury resulted from the low concentration of ammonium sulfate used.

Field studies in Gloucester County suggested that a wide range of fertilizer combinations may be used to advantage on asparagus. The maximum yield of first-grade asparagus was obtained on that plat receiving 1,500 lbs. of a ...7 mixture and 500 lbs. of common salt, all applied in the spring

Tomato seedlings resulting from Marglobe × Campbell Late, Marglobe × ...liana, and Marglobe × Bonny Best proved promising. Individual plant selections from Marglobe were made to improve this variety.

Beets grown in sand cultures with a deficiency of potassium developed red leaves and no storage roots, thus resembling closely nitrogen starved plants. In the minus potassium beet root most of the potassium present was localized in the root tip, and the roots grew in length but not laterally, since a lack of potassium resulted in no cambium to differentiate new tissues. The beet responded much as sweetpotato and tomato to a lack of potassium.

In cooperative studies with J. H. McGillivray of Purdue University and G. T. Nightingale tomatoes grown on plants of widely differing vegetative conditions were examined after canning for color of the resulting product. Although some difference was seen in color, the variations were not marked, suggesting that tomato pulp of good color may be produced from tomatoes grown on plants of widely different vigor.

The growth status of a plant may be greatly modified by the soil density, M. A. Blake and O. W. Davidson (*New Jersey Stas. Rpt. 1930, pp. 212, 213, figs. 2*).—Observing that most varieties of apples are more vegetative in clay loam than in sandy soils, a laboratory experiment was organized to determine the effects of soil density on growth, using as plant material rooted cuttings of the Marglobe tomato and as soil a quartz sand ground and in natural form. In neither case did the sand contain any nitrogen, but the moisture-holding capacity of the coarse material was 24.8 per cent and that of the ground sand 32.9 per cent. Each was maintained at approximately 50 per cent of its water-holding capacity during the experiment. No nutrients of any kind were applied.

In about 2 weeks the cuttings in the fine sand showed vegetative activity, developing their tips at the rate of about 1 in. per week and forming many new leaves. In contrast the cuttings in coarse sand assumed an increasingly yellow-green color, and their tips elongated at only about 60 per cent of the rate of the other lot, practically ceasing growth by the fourth week, with the lower leaves beginning to die. Root growth in the coarse sand was short and crinkly and much less than in the fine sand, despite the fact that both lots were handled exactly alike throughout. Apparently the physical nature of the soil greatly influenced the character of the top and root growth.

[Pomology at the New Jersey Stations], M. A. Blake and J. H. Clark (*New Jersey Stas. Rpt. 1930, pp. 38–40, 201–210, 214–219*).—A white-fleshed peach seedling, New Jersey No. 66 (J. H. Hale × 40 C. S.), deemed of sufficient promise to be distributed for trial to growers is described, and certain promising yellow-fleshed seedlings were increased for wider testing. A seedling from the 1925 crosses ripened 289 fruits in its third summer in the orchard. Very warm days occurring in January, 1930, were followed by more severe killing of peach buds than had occurred for many seasons. Hardy varieties, such as Greensboro and Carman, experienced little injury, while others lost as

high as 50 per cent of their buds. Similar differences were observed in the seedlings. J. H. Hale × Sunbeam seedlings were badly injured and J. H. Hale × Goldfinch seedlings showed consistent hardiness in one lot and variable hardiness in another. Despite the unfavorable conditions at blooming (27° F. minimum and cold, wet weather), many of the seedlings set so freely that thinning was necessary. Others failed to set and were discarded. Seedlings of J. H. Hale × Chili and J. H. Hale × Eclipse so closely resembled the pollen parents that pits were saved to start a second generation that segregation might be observed. One branch of a Golden Jubilee tree covered with cheesecloth during blooming set abundantly, indicating that this variety is self-fruitful.

Observations on the relation of bud injury to the location of the trees in the orchard showed heavy injury in trees located in depressions. Mexican Honey and Bolivian Cling proved notably resistant to cold. Although Elberta suffered only 2.5 per cent more bud killing than Oriole, which bore a good crop, the Elberta crop was a failure, apparently because the young trees did not hold their first set of fruit well unless the trees were above average in carbohydrates. Eclipse, Oriole, Radiance, Cumberland, Pioneer, Delicious, and Rosebud set well under the same conditions. During the years 1915 to 1930, inclusive, Elberta was in full bloom on April 5, 1921, and May 5 1920, with 50 per cent of the years falling between April 24 and May 5. Records taken on the time of full bloom in the Stayman apple from 1912 to 1930, inclusive, showed the earliest date on April 20, 1921, and the latest May 24, 1917, with 50 per cent of the full bloom days between May 7 and 15. Blooming dates are presented for various ornamental and fruit plants in the spring of 1930.

Pruning of young apple trees in the second and third season in the orchard so that branches were 8 to 10 in. apart inhibited total growth and increase in diameter of the trunks, leading to the conclusion that all possible growth consistent with development of the young tree should be allowed to remain during these years. Debudding of 1-year-old Delicious apple trees was found definitely to inhibit growth and induce the formation of narrow crotch angles with the trunk.

Small fruit investigations included a study of various ovicides for the control of the raspberry crown borer (*Bembecia marginata*). Volck and Pyrethrol gave excellent control. No material plant injury followed the use of Volck in dilutions of 1:125 or greater. Arsenate of lead sifted about the bases of Black Diamond raspberry canes failed to prevent the entrance of the larvae.

Open-pollinated seedlings of the Vineland 19322, a strawberry subject to noninfectious chlorosis, carried the trouble to the degree that many died before making runners, indicating that chlorosis is inherited or that its causal agent is transferred in the seed.

Strawberries grown in the greenhouse in quartz sand with nutrients supplied by the constant drip method showed the greatest gain in weight with a solution made up of the following partial volume-molecular concentrations: KH_2PO_4—0.0022, $Ca(NO_3)_2$—0.0108, and $MgSO_4$—0.0043.

Cooperative tests on five farms in Cumberland County of large and small sized Lupton strawberry plants for establishing new beds showed definitely in favor of the larger plants in the number of new runners formed and in yield. However, where plants were very good it is believed unnecessary to grade.

Of more than 1,800 strawberry seedlings fruiting in 1930, 100 were saved for further trial. Pearl × Aberdeen yielded highly promising seedlings, and several Mastodon × Howard 17 seedlings were saved because of their everbearing characteristics. Results presented of variety tests showed Latham and

Viking to be highly promising red raspberries and Sheridan a promising grape. Blooming data are presented for various small fruits.

[Spray residue studies at the New Jersey Stations] (*New Jersey Stas. Rpt. 1930, pp. 43, 44*).—Evidence was obtained to show that apples may be cleansed of residue much more easily when harvested than following storage. It was impossible to reduce the arsenic residue of Winesaps stored for 12 weeks in cold chambers to the export tolerance. Bruising was less in freshly picked fruits, and costs of residue removal were lower because of the lesser amount of acid required. Data on the cost of washing in three different devices are presented and show in favor of a homemade outfit.

Nitrate fertilization and keeping quality of apple fruits: Chemical, physiological, and storage studies, J. H. Gourley and E. F. Hopkins (*Ohio Sta. Bul. 479 (1931), pp. 66, figs. 35*).—An extended report on work previously noted (E. S. R., 64, p. 38).

Nitrate of soda applied to apple trees in sod and in tillage increased, particularly in the sod trees, the percentage of total nitrogen and also the actual amount of nitrogen in the fruits. For trees in sod there was a gradual decrease in the percentage of nitrogen in the fruit throughout the season for all treatments, while the total amount of nitrogen per apple increased. In the control trees the total amount of nitrogen became constant about the middle of summer, while in the nitrated trees an increase was found throughout the entire summer. Increased catalase activity was found closely correlated with the increased percentage of nitrogen, both in fruit and leaves. H-ion concentration of the juice was apparently not influenced by nitrates, whereas the total acid decreased to a minimum with 8 lbs. of nitrate of soda per tree and again increased as the applications were further increased. Apparently the buffer action of the juice of apples from nitrated trees was less than that of the control fruits. No connection was established between nitrate applications and the rate of respiration in the fruit nor between nitrate applications and soluble pectin content. The moisture content of Stayman apples grown in sod increased as a result of nitrating, the increase being apparently correlated with that of percentage nitrogen. Nitration decreased coloration of the fruit and increased its susceptibility to scald, but no consistent relation could be seen between fertilizers and the amount of decay or breakdown in storage.

Apple storage experiments, P. H. Thomas and T. D. Raphael (*Tasmanian Jour. Agr., 2 (1931), No. 1, pp. 5–11, figs. 3*).—Observations on the keeping quality of apples gathered at weekly intervals from the green immature to full ripe stage showed that the stage of harvesting exercised a marked effect on development of troubles in storage. Bitter pit was especially prevalent on the early-picked fruit and internal breakdown on the late-harvested plats. A delay in storing after picking had no appreciable influence on the development of bitter pit, but did increase the percentage of breakdown in Ribston Pippin. Holding 2 weeks in common storage following 10 weeks in cold storage did not cause further development of bitter pit but did increase breakdown in certain varieties.

The composition of apples and pears on the tree and in storage [trans. title], K. Meier (*Landw. Jahrb. Schweiz, 44 (1930), No. 5, pp. 589–597, fig. 1*).—Studies at the Wädenswil, Switzerland, Experimental Station showed that the water content, mineral content, and energy value of apples and pears are not constant but vary from year to year with the composition of the soil and the nature of the fertilizer. Average water content, total ash, and energy value per kilogram of edible substance were, respectively, 85.6 per cent, 0.23 per cent, and 564 calories for apples and 82.8 per cent, 0.36 per cent, and 674 calories for pears. Energy value varied during the course of the storage

period opposite to changes in water content and parallel with those in dry matter. Energy value for dry matter and for organic matter changed but little during storage. Apples gave an average energy value of 3.93 calories for each gram of dry substance. Changes in energy value for edible substance are explained on the basis of changes in dry matter content. No significant energy value changes were observed in dried pears and apples in storage. Dried apples with a water content of 10 per cent had between 3,538 and 3,550 calories.

Studies in fruit diseases.—VII, Raspberry inspection service and Canadian certified raspberry stock, G. H. BERKELEY (*Canada Dept. Agr. Pamphlet 139, n. ser. (1931), pp. 6, fig. 1*).—A statement of rules and regulations governing the production of disease-free nursery stock.

[Cranberry and blueberry investigations at the New Jersey Stations], C. S. BECKWITH (*New Jersey Stas. Rpt. 1930, pp. 170, 171, 172–174*).—The results of fertilizer studies are again summarized (E. S. R., 64, p. 140). Water table studies covering a 5-year period showed no great differences in yields of plats upon which the water was held at various depths, the yields in barrels per acre being 54, 63, 67, 70, and 68 at the surface, and 3- to 6-in., 6- to 9-in., 9- to 12-in., and 12- to 15-in. depths, respectively. The indication was in favor of holding the water level at least 6 in. below the surface. Water at or near the surface decreased the length of upright shoots, the tallest being on the deepest water level plat. The number of uprights was correlated in a general way with their length, being fewest where the water was near the surface and most numerous where the water was from 6 to 12 in. below. The warmer soil associated with a lowered water table is deemed the underlying cause since growth occurs early. The need on unsanded bogs of maintaining the water level at one point is stressed. In the first year when water tables were changed considerable rot occurred in that plat in which the water was raised to near the surface, a result due in the author's belief to disturbing the root systems.

Attempts to increase the color of poorly colored cranberries by ethylene gas did not give results. The gas did remove green pigments where present but left in the case of the Early Black variety a uniformly pink color. Color is the result of the action of light and heat, preferably while the berries are still on the vines. Off the vine heat induced wilting as well as color. At 55° F. in a moist atmosphere and in light berries colored quite well. At 35° the berries colored but little and then only in direct sunlight. Low temperature although slowing the coloring process favored keeping quality.

Overhead irrigation was found highly effective in preventing frost injury to cranberries. With a temperature as low as 19° on the nonirrigated bog, the minimum on the irrigated was 31°, and although ice formed on the latter, no frost damage occurred if irrigation was maintained until the ice disappeared the subsequent day. Overhead irrigation is conceded to be of only limited possibilities.

Blueberry pollination studies showed that selfing results in small, late-maturing berries, even if the pollen was carried promptly by bumblebees. Under natural conditions wild bees effect pollination, but in large commercial plantations colonies of bees are introduced, since wild bees do not work much on blueberries in early spring but later are the chief pollinators. Bushes inclosed with a small colony of honeybees in insect proof cages set a good crop as compared with no set in a similar cage without bees.

The cultivation of bananas in Palestine [trans. title], **A. HOURWITZ** (*Tel-Aviv: "Hassadeh," 1930, pp. 132, figs. 13*).—A general discussion (Hebrew) concerning varieties, culture, harvesting, marketing, etc.

Quality of Texas Lower Rio Grande Valley grapefruit, H. P. TRAUB, G. S. FRAPS, and W. H. FRIEND (*Amer. Soc. Hort. Sci. Proc., 26 (1929), pp. 286–296, figs. 2; abs. in Texas Sta. Circ. 59 (1930), p. 20*).—Grapefruit juice, described as a buffered biological solution, has a pH range of from 3.1 to 3.3. The total soluble solids decreased slightly and the titratable acids more rapidly with age, bringing about a gradual rise in the ratio of solids to acids. The slight changes found in the constituents of the juice were not sufficient to cause changes in palatability. No sour or very sour juices were encountered. The ratio of solids to acids was always greater than 7 and rose gradually to more than 9. Carotenoid pigment is deemed responsible for the color of pink-fleshed varieties. Between Marsh, Thompson, Foster, and Duncan the differences were chiefly in the number and the weight of seeds.

Mass planting from a physiological point of view, C. P. SIDERIS (*Pineapple Quart. [Hawaii. Pineapple Canners' Sta.], 1 (1931), No. 2, pp. 77–84, figs. 5*).—Factors concerned in the ability of the pineapple to thrive under conditions of close planting are the low water requirement of the species and the reduction of soil water loss through the more complete shading. Up to a maximum of 20,100 plants per acre total yields increased in almost direct proportion to the number of plants, although individual fruit size was materially reduced. The anatomy of the plant as concerns water absorption and transpiration is discussed. The practical suggestion is offered that close planting in order to be successful must be supported by thorough culture and abundant fertilization.

Pineapples in Formosa, K. SAKIMURA and J. STANLEY (*Pineapple Quart. [Hawaii. Pineapple Canners' Sta.], 1 (1931), No. 2, pp. 104–107*).—Brief statements are presented on the extent of the pineapple industry, varieties grown, and methods of culture employed. The native pineapple is immune to wilt, which affects the Smooth Cayenne variety to the extent of 9 to 15 per cent.

Terminal growth in relation to fruiting in the pecan, H. L. CRANE (*Natl. Pecan Assoc. Proc., 29 (1930), pp. 24–32*).—In an orchard of mixed varieties planted in 1910 yields per tree declined steadily from 1923 to 1929, whereas in an older orchard planted about 1897 the use of fertilizers and improved culture caused yields to increase from 1925 to 1929. Measurements of shoots in relation to bearing indicated that growths of from 5 to 15 in. are more productive than longer or shorter ones. The diameter of the shoot was also a factor, the thick, vigorously growing shoots being most favorable to flower bud formation.

Influence of fertilizer treatments on yield and quality of pecans, R. W. TAYLOR (*Natl. Pecan Assoc. Proc. 29 (1930), pp. 18, 20, 22*).—Over a 3-year period applications of nitrogen, phosphorus, and potassium increased the yield of Stuart pecans more than did phosphorus and potassium alone. However, in 1929 nuts from the completely fertilized trees were smaller and contained a smaller percentage of kernel as compared with those from the phosphorus plus potassium plats.

[Ornamental horticulture at the New Jersey Stations], C. H. CONNORS and H. M. BIEKART (*New Jersey Stas. Rpt. 1930, pp. 42, 43, 219–229, figs. 2*).—The extensive shrub collections were augmented by new accessions including many species of the heath and rose families. Heavy pruning of shrubs that normally bloom on wood grown the preceding season caused a marked deficiency of bloom and in several cases delayed blooming. Blooming records are presented for the various deciduous shrubs on trial.

Carnation plants grown in sand cultures with constant drip nutrient solutions produced excellent flowers but were not as productive as plants in soil cultures supplied with nutrients in the usual manner. The difference is believed due primarily to the quantity of nutrients supplied. With one variety, Laddie,

there was in the early season a better development in sand than in soil, with more flowers in midwinter. Tile drains placed in portions of the soil plats did not appreciably affect yields.

Paper white narcissus bulbs grown in South Carolina in 1928–29 on soils which had received no nitrogen and on soil which had received from 225 to 250 lbs. of nitrogen per acre were, after grading into two sizes, planted in December in tubs of sand to which minus nitrogen and plus nitrogen nutrients were applied every two weeks. Records taken in late May showed very definitely that the bulbs which had received the high nitrogen in the field produced the greater percentage of bulbs with offsets. The differences were more marked with the larger bulbs. Here the no nitrogen bulbs produced 86 per cent of bulbs with no offsets under the minus nitrogen treatment and 50 per cent under the high nitrogen treatment. The high nitrogen bulbs produced only 64 per cent of undivided bulbs under the minus nitrogen treatment and 46 per cent under the plus nitrogen treatment.

Bulbs grown in sand cultures in 1927, 1928, and 1929, part with no nitrogen and part with a liberal supply of nitrogen, gave much the same results as pertained to splitting, which occurred abundantly in the plus nitrogen group. The best bulbs were produced in the nonnitrogen lots, which, coupled with greater flower production, indicated that the paper white narcissus is able to reutilize its organic nitrogen supply for further growth even after three years' lack of supplied nitrogen. Bulbs with an abundant nitrogen supply were high in protein, relatively low in carbohydrates, and produced more offsets. The presence of a large number of offsets indicates an over-vegetative condition unfavorable to flower and round bulb production. Results secured with offsets or slips grown under different planes of nitrogen nutrition were even more striking than with the large bulbs.

FORESTRY

The effect of soil moisture on the establishment of spruce reproduction in British Columbia, P. M. Barr (*Yale Univ. School Forestry Bul. 26 (1930), pp. 78, figs. 21*).—Germination of Engelmann spruce seed was found negligible on undisturbed raw humus of the forest and abundant on exposed mineral soil. Trenching to eliminate root competition had no definite effect on germination in mineral soil but did aid slightly in humus. Reducing light by increasing shade reduced germination on both types of soil. Germination was greater on northern than on southern exposures. Water was apparently a limiting factor to germination in humus, since artificial watering increased germination considerably on this type of soil but had little effect on mineral soil. Under greenhouse conditions daily watering of humus induced liberal germination, and longer intervals between watering delayed germination. Under favorable water conditions germination was more rapid on humus than on clay.

After becoming established there was little or no difficulty for seedlings to survive droughts on either humus or mineral soils. Greater losses from disease occurred on the humus, whereas birds and insects injured many seedlings on the mineral soil.

In the forest the moisture content of humus soil was greater but more fluctuating than that of the mineral soil. Soil of northern slopes had a higher moisture content than that of southern slopes. Shading had little effect on soil moisture. In the forest moisture content did not fall below the wilting coefficient in either humus or mineral soil. The failure of seeds to germinate on humus is deemed due to their inability to absorb water from the particles of organic matter.

Does light burning stimulate aspen suckers? H. L. Shirley (*Jour. Forestry, 29 (1931), No. 4, pp. 524, 525*).—A light fire sufficient to burn only the leaves of the preceding season was found on a clear-cut area to stimulate the number of subsequent root suckers and also to increase their height. On partially cut and uncut areas the odds were not significant for numbers but did indicate stimulation to height development. The author believes that the increase in soil temperature due to the absorbing power of the blackened surface is the cause of the stimulation.

Pruning in young plantations, H. W. Hicock (*Jour. Forestry, 29 (1931), No. 4, pp. 541–543, fig. 1*).—The removal of approximately 75, 50, 25, and 0 per cent of the lower branches of red pines planted in 1920 with a spacing of 6 by 6 ft. resulted in the first two cases in a considerable decrease in height growth in the period 1924–1930, the percentages of increase over the original height being 154, 188, 295, and 280, respectively. As a result the author concludes that it is inadvisable to remove more than one-third of the living crown from comparable trees.

Some results of thinning 27-year old jack pine, T. Schantz-Hansen (*Jour. Forestry, 29 (1931), No. 4, pp. 544–550, figs. 3*).—Despite the fact that the thinnings of 69 per cent of the trees and 56 per cent of the cubic volume resulted in marked accretion in growth per acre of jack pine on the Cloquet Forest Experiment Station in Minnesota in the subsequent 5-year period as compared with check trees, the gains were not sufficient from an economical standpoint to justify thinning.

The variance of western yellow pine crown lengths or widths and stand density, A. C. McIntyre (*Jour. Forestry, 29 (1931), No. 4, pp. 604, 605*).—Measurements of crown width and length of all trees over 6 in. d. b. h. in 54 plats showed a marked negative correlation between volume per acre and crown width, with a positive correlation between volume and height of the crown.

Lumber production in Ohio, R. R. Paton (*Ohio Sta. Bul. 478 (1931), pp. 1, 3–40, figs. 14*).—A general discussion is given, with data on species and types, quantity of lumber produced in the State as a whole and in various districts, lumbering practices in vogue, the utilization of lumber, and suggestions for improvement.

DISEASES OF PLANTS

[Plant pathology at the Nebraska Station] (*Nebraska Sta. Rpt. [1930], pp. 22, 33–35*).—In studies of spindle tuber and other degeneration diseases of the potato, it was found that a number of insects not previously connected with spindle tuber and unmottled curly dwarf are able to transmit these diseases.

Alfalfa wilt (*Aplanobacter insidiosum*), found in all sections of the State, is conceded to be best controlled by the use of resistant varieties, such as Hardistan, Turkestan, and Provence. Some 3,000 selections of alfalfa were made for resistance, and cuttings taken from apparently healthy plants found in infected fields. Approximately 20,000 young plants were inoculated and transplanted to the field for observation as to resistance. In freezing tests of 25 Turkestan strains of alfalfa, marked differences were noted in resistance to frost injury, the hardier lines being apparently more resistant than Grimm.

None of the common spray methods were found effective in the control of cherry leaf spot (*Coccomyces hiemalis*).

A single spraying to control black rot of grapes gave decidedly beneficial results, and a second and third spraying afforded some additional control. Copper dust was about as effective as Bordeaux spray.

[Plant pathology at the New Jersey Stations], W. H. Martin (*New Jersey Stas. Rpt. 1930, pp. 15, 16, 51, 285, 351*).—Favorable results as respects each con-

trol (*Actinomyces scabies*) followed the addition to the fertilizer of 15 lbs. per acre of mercurous chloride. On the treated plats 92.1 per cent of the tubers were clean from scab as compared with 46.7 per cent on the plats receiving fertilizer alone. As concerned Rhizoctonia, 48 per cent of the potatoes were clean on the treated areas and only 1.5 per cent on the untreated.

In pot cultures potatoes growing in soil taken from a scab-infected field which had been fertilized with acid materials showed no scab in the first crop despite applications of lime and superphosphate. Scab occurred on the second crop, increasing with the amount of lime applied until only 46 per cent of the crop was clean where 4,000 lbs. were applied per acre. Superphosphate caused no scab and increased yields. Red clover planted after the second crop grew better in the limed pots, and superphosphate increased yields above the checks.

In potato spraying tests colloidal copper hydroxide and copper carbonate in rather low concentrations failed to give as good control of flea beetles and leafhoppers as did 5–7–50 Bordeaux mixture. Soda-Bordeaux mixture and a commercial Bordeaux mixture gave as good results as did the homemade mixture. Yields increased as the pressure was raised from 150 to 350 lbs., but the differences were not sufficient to be significant. Yields of the check plats averaged 228.4 bu. as compared with 279.6 bu. for the Bordeaux mixture plats, a result due for the greater part to the control of flea beetles and leafhoppers.

Brief surface sterilization with bichloride of mercury of tomato seed from diseased plants killed all organisms, indicating that such diseases as Fusarium, Verticillium and Alternaria are very rarely carried within the seed. The treatment of tomato seeds for 30 minutes in water heated to 55° C. (131° F.) did not seriously injure their viability. Other tests of 50° for 1 hour, 55° for 30 minutes, and 60° for 15 minutes showed no injury. Undried seeds were treated safely.

In cooperation with the Georgia Department of Agriculture, studies were made of 42 lots of Georgia-grown tomato plants. Only 5 lots were found disease free. Early blight (*Macrosporium solani*) was very common, and leaf spot (*Bacterium vesicatorium*) was noticeably prevalent.

Sulfurs were found ineffective and copper fungicide effective in controlling fruit spot of apple. Equally good control followed the application of 2–6–50 and 1–3–50 Bordeaux mixture. Where the disease is not abundant an application 4 weeks after petal fall is deemed adequate, but when prevalent at least three applications of Bordeaux mixture 17 days, 4 weeks, and 10 weeks after petal fall are essential. Copper-lime dust gave good control but injured the foliage and fruit. Colloidal sulfur gave good control of apple scab as shown on the leaves. The first scab spores matured on March 16 and the first discharge occurred on April 4. A delayed dormant application of concentrated lime sulfur 1–10 followed by a 2.5–5–50 Bordeaux mixture just before blooming gave the best control of anthracnose and scale of the dewberry.

A combination of cucumber seed treatment and soil treatment gave perfect control of damping-off under conditions which killed every seedling in untreated hills.

Eggplant wilt was more severe on limed than unlimed soils. In 55 lots of eggplants some variation was noted in susceptibility but none were immune to wilt. The eggplant fruit rot (*Phomopsis vexans*) was found to be carried under the seed coat of seeds saved from badly diseased fruits. One hour in formalin or bichloride of mercury failed to destroy the organism without seriously injuring the seed. Immersion in water at 55° C. for 15 minutes or 50° for 30 minutes killed the Phomopsis organism in lots that developed 74 per cent of infection when untreated.

Beet seed treated for 30 minutes in water at 55° C. was not seriously affected as regards germination, and the resulting plants showed less spotting and yellowing from *Phoma betae* and *Cercospora beticola* than did those from untreated seed. The first cutting was much heavier and four days earlier on the treated plats, and the second cutting was also larger.

The hazard of using high nitrogen fertilizer for peas was shown in relative stands of 100, 94, 72, 53, and 35 from check, 0–8–5, 2–8–5, 4–8–5, and 6–8–5 mixtures respectively. Better results were secured where all the nitrogen was applied as a side dressing after the peas were up or on the row just before the plants emerged. Root rot, on the other hand, was reduced by liberal fertilizing, with greatly increased yields as a result.

Pepper seed saved from healthy and mosaic plants yielded 3.2 per cent and 25.4 per cent of mosaic progeny, respectively. Two of the progeny of mosaic parents contained 60.4 and 72.2 per cent of mosaic, whereas 8.3 per cent was the highest in the healthy lots. Leaf roll was also transmitted through the seed.

Studies of the relation of the soil pH to club root infection of crucifers showed some reduction when liming brought the pH up from 7.6 to 7.8. However, the damage was serious enough to lead to the conclusion that control by liming is difficult in the field.

Mercuric chloride 1–1,000 for 10 minutes was found more effective than an organic mercury compound for the control of sweetpotato scurf. Dipping of roots of apparently clean sprouts in a 20–20–50 Bordeaux mixture or in the organic mercury compound slightly decreased yields. Only 33.6 per cent of the crop from the untreated sprouts was free from scurf as compared with 56.8 and 87.5 per cent for those treated with Bordeaux mixture and organic mercury. Bordeaux mixture gave better control of stem rot and gave larger yield gains than did the organic mercury.

Soaking gladiolus corms in mercuric chloride 1–1,000 plus 1 per cent of hydrochloric acid for seven hours gave an average of 76.6 per cent clean stock in three tests on three varieties as compared with 27.2 per cent for the checks. This treatment delayed germination an average of 4.6 days for 69 varieties and caused injury in the form of brown sunken areas near the base in some cases, but this injury was not correlated with delayed germination. Six organic mercury compounds caused no injury and gave large increases in clean corms.

A die-back condition of rhododendron caused by *Phytophthora cactorum* was found originating in neighboring lilacs. Cross-inoculations were made successfully between the two hosts. *P. cactorum* was found different from *P. syringae*, the former being more destructive. Wilt of the rhododendron caused by *P. cinnamomi* was found capable of transmission by inoculation to *Rhododendron ponticum*, *R. maximum*, *R. carolineanum*, *R. californicum*, *R. catawbiense*, *R. catawbiense* hybrids, and the Boule de Niege variety of *R. caucasicum*. Of the three strains of wilt the isolation from rhododendron in New Jersey was slower in invading the tissue. The three strains differed slightly in growth characteristics on various media but had similar temperature growth reactions.

The color of spore masses on potato dextrose agar of 24 strains of brown canker of the rose (*Diaporthe umbrina*) isolated in 1929 varied from cinnamon-buff on new to pale mauve on old cultures. Sulfur sprays were effective in control. Infection of canes occurred only on the young growing tips or on rapidly growing basal canes arising from the bud callus. Black spot was also controlled by sulfur sprays. Properly sprayed rose bushes practically disease free when entering storage passed the winter in a much healthier condition than did unsprayed plants.

Arranged according to host plants, a record is presented with incidental notes of plant diseases observed in New Jersey in 1928 and 1929.

[Plant pathology at the Tennessee Station], J. A. McClintock and C. D. Sherbakoff (*Tennessee Sta. Rpt. 1930, pp. 38–40, 42–44, 48*).—Seedling fruits developed as a result of breeding studies in search of resistant varieties showed some desirable characteristics both as to fire blight and leaf spot resistance. Satisfactory results were obtained at the main and branch stations with zinc chloride solutions for the control of fire blight in apples, pears, and quinces. Quince rust (*Gymnosporangium germinale*) was observed to be causing serious damage to apples resistant to the cedar rust (*G. juniperi-virginianae*).

In root knot studies with the peach, further evidence was obtained that the Marianna plum is not a satisfactory root stock for the peach, but some indication was observed that more congenial strains of Marianna may be isolated by selection. Rose seedlings were raised from stock varieties adapted to Tennessee conditions with a view to isolating nematode-resistant types. American mazzard cherry seedlings were found more resistant to leaf spot than were the French mazzards.

Spraying experiments with apples led to the conclusion that the early sprays are the most important in scab control, and that at least one preblossom spray must be applied but should be timed according to the weather. Because of some harmful effects of lime sulfur on fruit set, Bordeaux mixture is recommended for the later sprays.

Bacterial leaf spot and black fire of tobacco were very scarce, due to the drought, but black root rot occurred seriously in certain sections. Selection of wheats for resistance to scab and root rot was pursued with considerable promise.

A black root disease of the strawberry which caused the plants to wilt about the time fruit began to ripen is described with the comment that the trouble is especially noticeable during rainy seasons.

Cotton plants affected with Verticillium wilt dropped their top leaves first, the lower branches retaining their foliage for some time and the roots remaining green for a long period, whereas in the ordinary wilt the leaves wither gradually over the whole plant, and by the time they abscise the bark near the soil and the roots are dead. No upland variety of cotton proved resistant to this disease, although some difference was evident giving hopeful prospects for selection work.

At the Middle Tennessee Experiment Station, blight-resistant pears proved valuable as trunks and scaffolds upon which to bud susceptible varieties.

The production of agglutinins by phytopathogenic bacteria, M. C. Goldsworthy (*Phytopathology, 18 (1928), No. 3, pp. 277–288*).—The literature on the production of antisera against phytopathogenic bacteria is discussed, and the results are given of experiments including *Pseudomonas cerasus*, varieties 28 and 29 (two gummosis types), and *Bacterium maculicolum* (a cauliflower spot organism). Against all three forms, potent antisera were produced. Living antigens gave the best results when injected intravenously. Cross agglutination was not encountered.

The development in culture of Ascochyta gossypii Syd., H. G. Chippindale (*Brit. Mycol. Soc. Trans., 14 (1929), pt. 3–4, pp. 201–215, figs. 23*).—A condensed account is given of the life history of *A. gossypii* growing on various media in the laboratory. This organism is independent of light for its development, but is very susceptible to temperature changes, and excess carbon dioxide prevents the formation of pycnia.

Notes on the crowngall situation in England, France, and Holland, A. J. RIKER (*Phytopathology, 18 (1928), No. 3, pp. 289–294, fig. 1*).—Notes are given of a survey made of crown gall in this section as compared with that in the United States, the contrasting climatic conditions in the two regions being briefly described. A tabular summary is given for each Europeon country. "Although it seems that infections by *Bacterium tumefaciens* appear from time to time in all regions visited, the economic importance of true crown gall, except in isolated cases, is commonly very slight."

Pathogenicity of Pestalotia spp., R. P. WHITE (*New Jersey Stas. Rpt. 1930, pp. 264–268, figs. 3*).—Descriptions are given of the symptoms of four species of Pestalotia, namely, *P. palmarum*, *P. guepini*, *P. stellata*, and *P. funerea*. Inoculation experiments indicated that the four species cause infection only under very limited conditions, *P. palmarum* being unable to directly infect healthy tissue, and *P. guepini* being able to penetrate the tissue of *Camellia japonica* only through wounds, which should be disinfected and dressed. *P. stellata* on *Ilex opaca* was the weakest pathogene of all, while *P. funerea* was potentially serious to conifers of the pine family while in the propagating boxes. After this stage plants were kept healthy by spraying with a chlorophenol mercury preparation.

Recent studies on Phymatotrichum root-rot, J. J. TAUBENHAUS and W. N. EZEKIEL (*Amer. Jour. Bot., 17 (1930), No. 6, pp. 554–571, pl. 1, figs. 4; abs. in Texas Sta. Circ. 59 (1930), p. 19*).—A discussion of the distribution, symptoms, life history, and various environmental factors affecting occurrence and severity.

Soil taken from active zones of root rot spots did not upon inoculation transmit the disease to healthy plants. Root rot did not attack cotton plants grown in screened soil which had been taken from root rot spots, but did occur on plants grown in unsifted soil. Excavation failed to show spread from points of primary infection to adjacent roots except along infected roots. However, in the laboratory fungus strands grew to certain distances independently of the roots, but it is not yet established whether such behavior can occur in the field.

Studies on the overwintering of Phymatotrichum root rot, J. J. TAUBENHAUS and W. N. EZEKIEL (*Phytopathology, 20 (1930), No. 10, pp. 761–785, figs. 4; abs. in Texas Sta. Circ. 59 (1930), p. 21*).—Root rot fungus was found capable of overwintering on living roots of host plants, the tops of which had been killed by frost. The fungus could not survive on infected or decayed roots nor on decayed portions of living rots. The disease continued to spread during winter. The disease overwintered also as sclerotia which were found in the soil or were produced in the laboratory. Cotton was inoculated successfully with a pure culture developed from a sclerotium and with growth from sclerotia placed directly in the soil.

Soil-reaction effects on Phymatotrichum root rot, W. N. EZEKIEL, J. J. TAUBENHAUS, and E. C. CARLYLE (*Phytopathology, 20 (1930), No. 10, pp. 803–815, fig. 1; abs. in Texas Sta. Circ. 59 (1930), p. 21*).—The percentage of infection and the percentage of plants killed by root rot were higher in soils with the higher pH, that is, neutral or somewhat alkaline soils. The average period between inoculation and wilting was slightly longer and the root rot spread more slowly in the more acid soil. There was a marked diminution of root rot at about pH 6, with none at pH 5. Preliminary tests with sulfur as a control medium are briefly described.

Taxonomy of the genus Phytophthora de Bary, C. M. TUCKER (*Missouri Sta. Research Bul. 153 (1931), pp. 208, figs. 30*).—"Studies on the morphology of

the sexual and asexual organs of 150 isolations representing most of the species of Phytophthora indicate that morphological characters are of limited value in identifying species. The amphigynous or paragynous character of the antheridia is considered a constant character. Inoculations of various hosts reveal wide differences in pathogenicity between different isolations within some species, while other species may be identified by their ability to attack certain plants. The growth of the isolations on corn meal agar at various temperatures indicates that the temperature relations of the species vary widely, are fairly constant within species, and that the character is a valuable aid in distinguishing certain species.

"The ability of isolations to survive winter temperatures and long periods in culture is not generally correlated with the production of certain types of reproductive organs, but is, apparently, an inherent character of the particular species or strain.

"The taxonomic position of the genus and species is considered in detail, and a key for the identification of species is included. The characters considered of most importance for taxonomic purposes are ability to grow on certain media, type of antheridium, character of sporangium, temperature relations, and, in a few species, development of certain types of reproductive organs, size of oospores, and pathogenicity. The following species are maintained as valid and identifiable by these criteria: *P. infestans*, *P. cactorum*, *P. phaseoli*, *P. colocasiae*, *P. citrophthora*, *P. thalictri*, *P. palmivora*, *P. syringae*, *P. parasitica*, *P. erythroseptica*, *P. cambivora*, *P. cryptogea*, *P. capsici*, *P. cinnamomi*, *P. richardiae*, and *P. boehmeriae*. A new variety, *P. parasitica nicotianae*, and a new species, *P. drechsleri*, are described."

Experiments on the control of barley stripe, H. A. Rodenhiser (*Phytopathology, 18 (1928), No. 3, pp. 295–300*).—In attempts to improve methods of treating barley stripe, 4 liquid fungicides, used at different temperatures and periods of soak, and 10 dust fungicides were tested. It is stated that the effectiveness of the liquid fungicides depends on the temperature of the solution and the period of soak. Uspulun and Semesan were the most satisfactory fungicides for the control of stripe when the seed was soaked for one hour at room temperature. Upsulun, Germisan, and Semesan were about equally effective when the seed was soaked at 45° C. for one-half hour. Yields were somewhat increased following treatment with the organic mercury compounds, although hot Germisan caused a delay in heading. Hot formaldehyde reduced the yields in 1925, and also caused a delay in heading. K–I–A and K–I–B dusts eliminated stripe entirely, while Du Pont Dust No. 12, S. A. F. Dust No. 225, and Wa Wa Dust were almost as effective. Coppercarb and Kolodust were ineffective.

Club root in relation to soil alkalinity, C. Chupp (*Phytopathology, 18 (1928), No. 3, pp. 301–306, fig. 1*).—Under the conditions described, the upper limit at which *Plasmodiophora brassicae* may cause infection appears to be from pH 7.2 to 7.4, the amount of disease increasing rapidly with a rise in soil acidity. At pH 6.0 or even above, 100 per cent infection is possible. Sulfur injures the cabbage plant without controlling clubroot.

Control of seed decay and damping-off of cucumbers, C. M. Haenseler (*New Jersey Stas. Rpt. 1930, pp. 254–264*).—Of various materials tested for treating cucumber seed, copper carbonate and slowly soluble organic mercury compounds gave the best results under greenhouse conditions. Semesan Jr. applied to glue-moistened seed at the rate of 1 part to 20 parts of seed gave the best control of decay and damping-off. Germination was retarded one to two days without permanent injury. Under conditions of moderate decay and damping-off, seed treatment alone was sufficient. However, when supplemented by soil treatment such as formalin 1–100 or 1–200 applied to the hill

just after planting, seed treatment was more effective. A formalin-Bordeaux mixture soil treatment plus seed treatment gave complete control in certain cases. Bordeaux mixture and copper-lime dust applied at the time of germination without formalin gave, with seed treatment, good control.

Varietal susceptibility of potatoes to Fusarium wilt and stem-end rot, R. W. Goss (*Phytopathology, 18 (1928), No. 3, pp. 307–309*).—Observations during the previous seven years indicate considerable variation in the susceptibility of potatoes grown in Nebraska to Fusarium wilt and stem-end rot (*F. eumartii*), previously described (E. S. R., 51, p. 752). The results of tests as tabulated show that Irish Cobbler and Early Ohio potatoes are equally susceptible and much more so than Bliss Triumph as regards wilt, and it is held that these varieties should never be planted on heavily infested soils.

The results with seed treatments were not very conclusive. From the facts that in 1926 some decrease in infection followed the use of Semesan Bel, but that in 1927 no beneficial results followed such treatment (rather a slight increase), it is concluded that either the disinfectant has no great value in protecting the seed piece from infection or else infection takes place through the roots (supposedly the most common method in Nebraska).

Predisposition of sugar-beets to late rootrot, G. Stewart and D. W. Pittman (*Phytopathology, 18 (1928), No. 3, pp. 263–276, figs. 3*).—Of the recent sugar beet disease epidemics in the Rocky Mountain region during the previous few years, the most important outbreaks were those of curly top, and, more particularly, late root rot, which latter injured beets heavily on soils low in fertility, intermediately on soils of intermediate fertility, and hardly at all on soils of high productivity even when adjacent, on every side, to plats fully infected.

Low productivity predisposes to root rot very definitely, good soil treatment constituting supposedly the only practical means of control.

Mosaic disease of tobacco, C. G. Vinson and A. W. Petre (*Bot. Gaz., 87 (1929), No. 1, pp. 14–38*).—This paper details the results obtained in removing the virus from infectious juice by methods described in the paper by Vinson previously noted (E. S. R., 58, p. 447), and reports also further progress in freeing the virus of accompanying solids. The behavior of the virus is found to present many analogies to that of a chemical substance.

Inoculating methods in tobacco mosaic studies, F. O. Holmes (*Bot. Gaz., 87 (1929), No. 1, pp. 56–63, figs. 4*).—The most effective way yet found to transfer mosaic virus to tobacco plants is to rub gently over a large surface of the leaf a cloth soaked in mosaic plant extract. Scratches are much less effective, even when made with the virus-containing extract in contact. The virus of tobacco mosaic does not readily enter the wounds made before its application in leaves of healthy tobacco plants, but a suitable wound made in the presence of the virus seems to give instantaneous entrance to the virus. Immediate removal of the excess of mosaic extract by washing does not decrease the total of infections, but in some cases increases it.

Tentative classification of symptomatic types of "tomato pockets," H. P. Traub, W. S. Hotchkiss, and P. R. Johnson (*Plant Physiol., 5 (1930), No. 2, pp. 235–240, figs. 5; abs. in Texas Sta. Circ. 59 (1930), pp. 21, 22*).—A tentative classification of symptomatic types of tomato pockets is presented, based on studies of over 5,000 diseased specimens. A gradual transition from one type to another was evident, the symptoms being dependent apparently on the stage of development of the fruit when attacked. The designation tomato pockets is deemed most applicable to this disease.

Diseases of watermelons in Florida, M. N. Walker and G. F. Weber (*Florida Sta. Bul. 225 (1931), pp. 52, figs. 30*).—General information is pre-

sented on various diseases as to their symptoms, importance, distribution, methods of control, etc.

Composition of avocado trees in relation to chlorosis and tip-burn, A. R. C. Haas (*Bot. Gaz., 87 (1929), No. 3, pp. 422–430*).—Lime-induced chlorosis in avocado trees raises the calcium-magnesium ratio. The total and the water-soluble calcium of normal mature avocado leaves are much less than in citrus leaves. The magnesium in such leaves is two or three times that in citrus leaves. Chlorotic avocado leaves have been found to contain considerable water-insoluble calcium and water-soluble potassium. The totals of nitrogen and phosphorus in avocado leaves about equal those in citrus leaves. Tipburn of avocado leaves proves to be associated with a high chloride or sulfur leaf content.

Mottle-leaf in citrus artificially produced by lithium, A. R. C. Haas (*Bot. Gaz., 87 (1929), No. 5, pp. 630–641, figs. 4*).—In citrus mottle leaf produced artificially in sand and soil cultures, also in the field, by the use of lithium, this element is assumed to act as a poison to the growth processes in the leaves, preventing full utilization by them of the inorganic salts in the tracheal sap, so that as a consequence of the effect of the poison on the growth processes the old mottled leaves have the composition of immature normal leaves.

Sap analyses of citrus trees in the field show that, although the leaves of mottled trees may show calcium deficiency, the tracheal sap may show high calcium concentrations. This is possibly owing to the inability of the mottled leaves to utilize calcium.

Though no lithium is yet known to occur in citrus leaves, success in the artificial production of mottle leaf by use of lithium widens the knowledge regarding this trouble.

The heat resistance of some pineapple pathogens and other fungi, M. Lorimer and M. B. Linford (*Pineapple Quart. [Hawaii. Pineapple Canners' Sta.], 1 (1931), No. 2, pp. 62–67, fig. 1*).—The results are presented largely in graphical form of determinations of the degree of heat and the duration of the heating period required to kill a number of parasites and saprophytes. The mycelium and the spores or sclerotia were tested separately when possible. Of 14 fungi tested, the 5 that were killed most readily were parasites on the pineapple. The black rot organism, Thielaviopsis, was highly resistant, being exceeded in this respect by only a few saprophytes. Some work on the pineapple plant itself indicated that crowns may be heated to a point sufficient to destroy the pathogenes without injury to the plant. The possible rôle of the sun's heat in pathogene destruction is considered.

Tobacco dust and yellow spot control, W. Carter (*Pineapple Quart. [Hawaii. Pineapple Canners' Sta.], 1 (1931), No. 2, pp. 99–104, fig. 1*).—Of seven forms of tobacco extracts compared with tobacco dust as a control of the virus disease of the pineapple known as yellow spot, none had any significant effect in reducing the disease. The beneficial effect of tobacco dust is believed to lie in changes induced within the plant itself. The incidence of the disease was conditioned by the vigor and succulence of the plant, the infestation being lower in the poorly vegetative plants.

The development of the root knot nematode in root tissues, G. H. Godfrey and J. Oliveira (*Pineapple Quart. [Hawaii. Pineapple Canners' Sta.], 1 (1931), No. 2, pp. 67–77, figs. 5*).—Observations on the time and manner of penetration of nematodes into the roots of pineapples and cowpeas indicated that penetration takes place quickly where the larvae are very numerous, mass action apparently playing a rôle in the heavy invasion. The host plant, as well as temperature, was found an important factor in influencing the length

of the life history of the root knot nematode. Whereas the time required for penetration and migration was about the same in the pineapple and cowpea, the period required to attain the uniform fusoid form common to males and females was considerably longer in the pineapple, 24 days as compared with 8 to 9 days in the cowpea. The first eggs were not observed until about the thirty-fifth day in the pineapple and the nineteenth in the cowpea. These differences in life history are deemed important in regulating the rapidity of multiplication. Furthermore, egg masses broke out through the cowpea and weed roots much more readily than through pineapple tissues—obviously another factor in the rate of propagation.

ECONOMIC ZOOLOGY—ENTOMOLOGY

Animal aggregations: A study in general sociology, W. C. Allee (*Chicago: Univ. Chicago Press, 1931, pp. IX+431, figs. 36*).—Following an introduction (pp. 1–97), the author considers the harmful (pp. 99–144), beneficial (pp. 145–285), and general effects of aggregations (pp. 287–334), followed by a conclusion (pp. 335–362) and a bibliography of 45 pages.

Hints on bobcat trapping, S. P. Young (*U. S. Dept. Agr. Leaflet 78 (1931), pp. II+6, figs. 4*).—A brief account is given of methods of trapping the bobcat, trapping having been found to be one of the most effective means of control. On its wild ranges the bobcat feeds to a large extent upon rabbits and other injurious rodents, but it preys also upon such valuable forms of wild life as antelope, deer, and other game animals, especially the fawns, and on wild turkeys, quail, and other ground-nesting birds. With human occupation of its former haunts, it may become exceedingly destructive to domestic animals, especially to sheep during the lambing season, to pigs, goats, and calves, and to poultry. It is pointed out that the bobcat has keen eyesight and a good sense of smell, though the latter is not so acute as in the wolf or the coyote. Most of its hunting for food is done at night, and the animal is aided by sight rather than by scent.

Insects and climate, B. P. Uvarov (*Ent. Soc. London, Trans., 79 (1931), pt. 1, pp. 247, figs. 53*).—The first part of this work (pp. 7–86) deals with the physical factors of insect life under the headings of heat, humidity, other climatic factors, and combinations of several factors. Part 2 (pp. 87–186) takes up weather, climate, and insects under the headings of the relation of weather to the activities of insects, daily and annual cycles, climate and distribution, effect of climate on abundance, and climate and weather in economic entomology. A bibliography of 45 pages and author and subject indexes are included.

Symposium: The effect of the 1930 drought upon insect population (*Jour. Econ. Ent., 24 (1931), No. 3, pp. 651–662*).—The several contributions to this symposium are as follows: The Effect on Cereal Crop Insects, by W. H. Larrimer (pp. 651–653); The Effect on Cereal Crop Insects, by W. P. Flint (pp. 653–656); The Effect on Leaf-Hopper Populations for 1930, by H. Osborn (pp. 656, 657); Effect on Shade Tree and Forest Insects, by J. S. Houser (pp. 657, 658); The Effect upon Fruit Insects, by W. S. Hough (pp. 658, 659); and The Effect on the Mexican Bean Beetle, by N. F. Howard (p. 660).

A new automatic insect trap for the study of insect dispersion and flight associations, F. A. Fulton and J. C. Chamberlin (*Jour. Econ. Ent., 24 (1931), No. 3, pp. 757–761, pl. 1, fig. 1*).—A description is given of an insect trap which automatically receives and retains the insects borne by a representative moving current of air, and its application to studies of insect dispersal and flight associations, with special reference to the beet leafhopper, is discussed

Rearing houseflies for testing contact insecticides, G. L. Hockenyos (*Jour. Econ. Ent., 24 (1931), No. 3, pp. 717–725, figs. 4*).—An account is given of a technic employed for rearing house flies for testing purposes which differs from that usually employed only in the media and apparatus used. Improved testing cages which make possible more rapid tests are also described and some representative results given. A method for making tests on individual house flies is described, and it is shown that certain contact poisons are absorbed directly through the body wall and do not need to enter the trachea.

A numerical rating for the contact performance of a spray material (Studies in contact insecticides, III), W. C. O'Kane, W. A. Westgate, L. C. Glover, and P. R. Lowry (*New Hampshire Sta. Tech. Bul. 46 (1931), pp. 8, figs. 2*).—In continuation of the study (E. S. R., 63, p. 550) the authors report upon the visible result of the combined effects of the various factors involved in bringing about the extension or "spreading" of a spray material over a solid, such as a leaf or the body of an insect. An attempt was made to reduce to a numerical scale the net result, as evidenced in so-called "spreading," when a droplet of a given liquid is placed on a given solid, that is, a method of appraisal of the so-called "wetting ability" of a liquid for a solid.

The report on the work includes an equation for determining relative areas from angles of contact, prepared with the assistance of H. L. Slobin and W. E. Wilbur. The details are presented in chart and tabular form.

Excerpts from consular correspondence relating to insecticidal and fish-poison plants, R. C. Roark (*U. S. Dept. Agr., Bur. Chem. and Soils, 1931, pp. 39*).—This is a compilation of information on the occurrence and use of a wide variety of fish poisoning and insecticidal plants that has been received from American consuls in all the tropical countries. The information is presented under the headings of the plants, arranged alphabetically according to genus.

The relative toxicity of rotenone and nicotine to Aphis rumicis L. and mosquito larvae, H. H. Shepard (*Jour. Econ. Ent., 24 (1931), No. 3, pp. 725–731*).—Rotenone has been found to be more toxic than nicotine when applied as a contact insecticide to *A. rumicis* and mosquito larvae. Deterioration in either acetone or alcohol stock solutions was not detected in these tests of toxicity. The effect of acid or alkali added to rotenone suspensions has been investigated and discussed in connection with the spreaders, sodium fish-oil soap, and saponin.

A preliminary report on the insecticidal properties of devil's shoestring (Cracca virginiana Linn.), V. A. Little (*Jour. Econ. Ent., 24 (1931), No. 3, pp. 743–754*).—This is a report of studies conducted, of which an earlier account has been noted (E. S. R., 65, p. 547). Aqueous suspensions of the powdered roots have been found to compare favorably in toxicity with Derris, pyrethrum, and nicotine sulfate (40 per cent). Field experiments show the insecticide to be efficient in the control of a number of insects, especially animal parasites.

Refined pine tar oil for orchard and garden use, E. R. de Ong (*Jour. Econ. Ent., 24 (1931), No. 3, pp. 736–743*).—It is pointed out that pine tar oil, produced by the destructive distillation of pine wood, is now being used in refined form as an insecticide and fungicide. "This oil is used alone or in combination with nicotine for the control of aphids, thrips, and similar types of insects. Pine tar oil has greater fungicidal value than petroleum oil and also may act as a carrier for copper resinate, which it dissolves readily. The combination of pine tar oil and copper resinate may be added to petroleum oil and the blend emulsified in the usual way."

Studies with hydrated ferric oxide as corrective and sticker for lead arsenate and nicotine tannate, J. M. GINSBURG and R. F. MANN (*Jour. Econ. Ent., 24 (1931), No. 3, pp. 695–701*).—Tests with several grades of hydrated ferric oxide were carried out at the New Jersey Experiment Stations for the purpose of determining their value as stickers and correctives for arsenical injury on apple foliage. Hydrated ferric oxide mixed with lead arsenate increased the adhesive properties of the latter to apple foliage and prevented arsenical injury. Hydrated ferric oxide by itself does not injure apple and peach foliage. A mixture of hydrated ferric oxide and skim milk was found to possess good spreading and sticking qualities for insecticides and fungicides.

A power spray outfit adapted for applying small quantities of material, F. W. METZGER and A. R. WHITCRAFT (*Jour. Econ. Ent., 24 (1931), No. 3, pp. 754–757, pl. 1, fig. 1*).—A description is given of an outfit which can be used for applying small quantities of material under field conditions. It is said to have been used extensively and satisfactorily during the summer of 1930, over 2,500 gal. of spray material having been applied.

Report of the department of entomology, T. J. HEADLEE ET AL. (*New Jersey Stas. Rpt. 1930, pp. 121–170, 171, 172, 175–200*).—Under the heading of Mosquito Investigations and Control (pp. 121–136) reports are presented on an investigation of the egg-laying habits of *Aedes sylvestris* (pp. 121, 122), mosquitoes of the year (pp. 122–126), rainfall and its relation to mosquito production (p. 126), correlation of county antimosquito effort (p. 131), education and publicity (pp. 131, 132), plans and surveys (p. 132), and outstanding activities of the year (pp. 133–136), all by F. W. Miller; Oils and Larvicides to Control Mosquito Breeding in Sewage Disposal Plants, by J. M. Ginsburg and L. Forman (pp. 127–130); and Pyrethrum Larvicide to Exterminate Mosquitoes without Injury to Waterfowl, Fish, and Vegetation, by J. M. Ginsburg (p. 130).

The results of sample breeding clearly indicated that the eggs of *A. sylvestris* laid in one year may hatch throughout the following season, although indications are that the bulk of overwintering eggs will develop early in the year provided the depository is wet. Large increases in *A. sylvestris* breeding occurring after the spring brood emerged indicated either that eggs laid during the season hatch, at least in part, during that season or that retardation conditions prevail, which when released permit previously retarded overwintered eggs to hatch. It would also seem to be indicated from close observations that, although the eggs of *A. sylvestris* are not laid promiscuously, there does exist a wide divergence in selection of egg depositories. The mosquitoes that appeared during the year in sufficient numbers to be of importance were *A. sollicitans*, *A. cantator*, *A. sylvestris*, *A. canadensis*, *Culex pipiens*, and *Mansonia perturbans*.

It became clear from the work of the year that the oils commonly used in mosquito control work can be safely applied on sewage disposal plants without in any way interfering with the chemical and bacteriological activities in sewage disposal. When a kerosene extract of pyrethrum (1 lb. to the gallon) is emulsified with 1 or 2 per cent soap and one-third its volume of water, its toxicity to larvae and pupae is retained even at high dilutions with water, such as 1 part emulsion to 15 parts of water. The amount of oil at that dilution, when applied on the surface of the water, is reduced to about 5 per cent, or approximately 2 gal. of oil to each acre of water surface. This thin film of oil containing the pyrethrum extract proved nontoxic to fish, waterfowl, and aquatic plants. The cost of this larvicide when used at the 1 to 15 dilution amounts to from 4 to 6 cts. a gallon, and its lasting quality is about the same as that of light fuel oil. Toxicity of oil extracts of pyrethrum to larvae and pupae bears

no relationship to the volume of water and is inversely proportional to the surface area, whereas the toxicity of alcoholic extract is inversely proportional to the volume of water.

Under Climate and Insect Investigations (pp. 136–142), the use of the thermal constant for timing of treatments for codling moth and further studies of the effect of electromagnetic waves on insects are dealt with. From the data obtained it is concluded that the thermal constant is a reliable indicator of the time when cover spraying should begin against first and second broods of codling moth. The data on electromagnetic waves indicate that there is such a thing as selective frequency, that when the proper frequency for an organism is reached that organism may be stimulated and killed with a minimum expenditure of electric energy, and that that frequency with its adequate field strength will stimulate and kill another organism only with much longer periods of exposure or a much greater expenditure of electric energy. It is thought that this principle of selective frequency may prove a powerful instrument in affecting the relationship existing between host and parasite, especially when the host is a plant and the parasite an animal, as an insect. It is likely that the same principle may be utilized for affecting not only living matter but compounds, substances, and molecules. At any rate there is considered to be sufficient evidence of the existence of a natural frequency to justify a thorough investigation of the whole matter.

In reporting upon Orchard Insect Investigations (pp. 142–159), studies of agents for destroying overwintering codling moth larvae, the use of oil emulsion and cresylic acid against the overwintering eggs of the green and rosy apple aphids and the red mite, and studies of the leopard moth as an apple orchard problem are considered, followed by an account of Oriental Peach Moth Investigations, by B. F. Driggers (pp. 148–159).

Blocks of trees treated with pine oil showed a material reduction in the amount of injury caused by the first brood of codling moth. No material injury was done to orchard trees by the use of oil emulsion and cresylic acid, which were for the first time recommended as a regular delayed dormant spray for the destruction of overwintering eggs of green and rosy apple aphids and of European red mite and were widely applied. This material is considered promising, being much cheaper than any other treatment having anywhere near the same efficiency.

The studies have shown the larvae of the leopard moth to be killed by treating the twigs and branches of infested apple trees with soluble pine oil in which has been dissolved naphthalene, nicotine, or benzyl chloride. "Soluble pine oil in which naphthalene has been dissolved will destroy larvae of the leopard moth when applied thoroughly to the twigs and branches of apple under temperatures such as obtained in the spring before the buds begin to swell. This destruction of the larvae of the leopard moth may be obtained without material injury to the fruit and leaf buds of several varieties of apples, provided its application is not immediately followed by rapid development of the buds, such as would occur in periods of extremely warm weather."

In insectary tests of talc dust in combating the oriental fruit moth (E. S. R., 61, p. 552), there was a variation in the percentage of larvae killed by the different samples, this apparently being due to a variation in the proportion of jagged fiberlike particles and the more or less platelike and rounded particles in the different talc samples. It was found that there was approximately a 50 per cent increase in kill over straight sulfur when 1 part of talc was mixed with 3 parts of sulfur. Larger proportions of talc to sulfur resulted in increased kills of larvae. A report of its use in field tests has been noted (E. S. R., 63, p. 460). "Peach moth eggs placed in the dusted trees came through

unparasitized, whereas eggs placed in the check trees were parasitized to the extent of approximately 40 per cent. This finding is considered to explain in part the failure of the dust to hold down the infestation in this orchard. The reduction in wormy fruit due to the four spray applications of 1 per cent actual oil in the oil-spray test was negligible. From the results obtained in the field and laboratory studies it appears that the strength of the oil used in the final spray, or the amount or nature of the impregnating materials, will have to be modified if white oils are to be effective as a control for the oriental fruit moth. The results obtained from the Pineol Soluble tests against overwintering larvae on peach trunks and orchard débris showed that diluted 1 to 1 with water it was not effective in killing the larvae. It is thought that poor penetration of the peach bark would account in part for the low kill. Up to July 15 the Pineol Soluble as applied to the trunks and large branches of orchard trees had had no deleterious effect.

Under the heading of Insecticide Investigations (pp. 159–169), arsenical substitutes are briefly considered, followed by an account of Oil-Pyrethrum Sprays Containing Copper Oleate and Their Effect on Apple Trees (pp. 160–163), Studies on Penetration of Oils into Plant Tissues (pp. 163–167), and The Use of Certain Highly Penetrating Pine Oil Derivatives as Adjuncts in Contact Insecticides (pp. 167, 168), all by J. M. Ginsburg, and Studies of the Practical Use of the Reduced Nicotine Charge against Various Insects (pp. 168, 169).

Close observations disclosed no distinct injury to foliage from any one of the eight different compositions of summer oil sprays, but after the third application the foliage on the oil-sprayed blocks began to assume a darker green color than that of the unsprayed block. This phenomenon was more noticeable in the trees receiving petroleum oils than in the trees sprayed with sperm oil. The green color was especially intense in leaves of the Gravenstein sprayed with Nujol containing copper oleate. The spray mixture of lead arsenate containing either sperm oil or Nujol exhibited very good adhesion to foliage, as compared with standard blocks in the orchard. Close observations after each application of oil-copper oleate sprays failed to reveal any injury to foliage or fruit. It was found that lubricating oils, even when highly refined (freed from unsaturated hydrocarbons) may penetrate apple leaf tissue when applied on the under surface and cause injury to foliage in this way. Experiments conducted indicate that apple twigs can absorb mineral oil of viscosities ranging from 30 to 320 into the conductive tissue and carry them upward 7 in. or higher. Oils of lower viscosities such as 30, 55, and 81 can penetrate from the vascular bundles into the petioles of the leaves. Oils ranging in viscosities from 145 to 320 did not penetrate at all through the young bark of the twig. Oils having viscosities of 81 and 125 exhibited only slight penetration through the bark.

Reporting upon Vegetable Insect Investigations (pp. 169, 170), the Mexican bean beetle and the pepper maggot, including work with insecticides (E. S. R., 63, p. 462), are briefly considered by R. C. Burdette. Under Cranberry and Blueberry Investigations, the blossom worm and the blunt-nosed leafhopper (E. S. R., 62, p. 756) are dealt with by C. S. Beckwith (pp. 171, 172). In Soil-Infesting Insect Investigations (pp. 175, 176), studies of wireworm control are briefly considered.

In reporting upon Bee Investigations (pp. 176–182), R. Hutton deals with the relation of honeybees to orchard pollination, including the influence of colony strength on orchard activity and the comparative activity of paired colonies of Italian and Caucasian bees at different temperatures; breeding bees; honey production in the suburban area; wax extraction; and the number of bees

during winter. From studies of bees and their relation to orchard pollination it appears that a colony, to exhibit numbers of pollen-carrying bees, must have a need for the pollen in the form of a growing brood area.

Investigations of Insects Injurious to Ornamentals (pp. 182–200), including control work with several insects attacking evergreens (the European pine-shoot moth, the juniper webworm (*Dichomeris marginellus* Fab.), and the spruce needle miner (*Taniva albolineana* Kearf.), the penetration of arsenate of lead into sod, and the toxicity of several lead arsenates to the different instars of the grubs of the brown garden beetle (*Autoserica castanea* (Arr.)), are reported by C. C. Hamilton, the details being given in tabular form. The work indicated that dormant sprays are of no value in combating the European pine-shoot moth, but that 3 or 4 summer applications of a good contact insecticide, if applied at intervals of not more than 6 or 7 days beginning with the start of the emergence period, should kill the moths and in addition should probably kill most of the eggs before the larvae hatch and burrow into the twigs. The work also indicates that a fairly good control of the juniper webworm might be obtained early in the spring before the moths emerge by using a good summer contact spray. The application of Penetrol plus a kerosene extract of pyrethrum, making a dilution of 0.75 per cent Penetrol and the extract of pyrethrum flowers equal to 0.4 per cent pyrethrum flowers, applied to a block of Colorado blue spruce, and Pyrethrol diluted 1 to 100 to another block, both gave very satisfactory control of *T. labolineana* and improved the condition of the trees considerably.

No important differences were observed in the penetration of the soil by the three kinds of arsenate of lead used, namely, (1) a dry powdered arsenate of lead, (2) a dry powdered so-called colloidal arsenate of lead, and (3) a so-called paste colloidal arsenate of lead containing 40 per cent of water. In combating grubs of the brown garden beetle no great differences were observed in the time necessary for the three kinds of lead arsenate, including two so-called colloidal arsenates of lead, the particles of which carried a strong negative charge, to kill the first instar grubs. The second instar grubs were slightly more difficult to kill than the first instar grubs, as evidenced by the fact that the average time required varied from 3.5 to 11 days. The increased toxicity of the larger amounts of lead arsenate begins to show up in the tests on the second instar grubs, 2.5 lbs. requiring in most instances approximately twice as long to produce an average kill as the 15 lbs. of arsenate of lead. No significant difference in the toxicity of the three kinds of lead arsenate used was evidenced in the tests on the second instar grubs. Tests with the third instar grubs required on the average a considerably longer time to produce a satisfactory kill than was necessary with the first and second instar grubs. The longer average time to kill was in most cases apparently due to a few individuals which lived for a considerable length of time in the tins containing the poison mixture. In most instances more than half of the grubs in the third instar tests were dead at the 9-day period.

[Report of work in entomology at the Tennessee Station], S. MARCOVITCH (*Tennessee Sta. Rpt. 1930, pp. 35–37*).—In reporting upon arsenical substitutes for spraying the peach, it is stated that no foliage injury was produced by lead arsenate at Knoxville but that at Kingston severe defoliation resulted from four applications. No injury whatever was noticed on trees receiving cryolite or barium fluosilicate at the rate of 1 lb. to 50 gal. of water. There was little difference in the control of the curculio by the lead arsenate and fluorine sprays, but the latter showed more efficiency when used against the oriental fruit moth larvae. From the average infestation by the curculio of 60.9 per cent on check plats, lead arsenate sprays reduced the infestation to 8.66 per cent

and the fluorine sprays to 8.73 per cent. From the average of 48.1 per cent infestation on the check plat by the oriental fruit moth, it was reduced to 23.6 per cent infestation on lead arsenate plats and 13.44 per cent on the plats sprayed with the fluorine compounds. The best reduction in infestation was shown by the 50 per cent barium fluosilicate dust, when the curculio percentage was 7 per cent and the oriental fruit moth larvae only 8.72. It is concluded that the experimental work of the year with fluorine compounds for the control of the peach insects has shown them to have the following advantages over lead arsenate: (1) They can be used in the dust form more effectively than sprays, (2) they are not noticeably injurious to foliage, and (3) they leave a comparatively harmless residue.

In preliminary work aimed at the determination of the effect of soil on root infestation of the woolly aphid, in which apple trees were planted in soils with varying proportions of sand, sandy soil appeared to be unfavorable. This is thought to be due to the fact that aerial forms are able to reach the roots only through the cracks in the soil.

In light trap work with cutworm moths, 63 additional species were captured during the year, bringing the total up to 218 species of Noctuidae occurring in the State.

Notes are given on the occurrence of several of the insect pests of the year. A dust of 50 per cent cryolite and 50 per cent talc was used with success in combating the cabbage looper. The stems of young tomato plants growing in a hot bed were found infested on March 22 with larvae of the seed-corn maggot. A loss of more than $200 worth of plants had taken place in one bed before discovery. This is said to be the first record of injury in the State due to its boring into tomato stems.

[Notes on economic insects and their control] (*Jour. Econ. Ent., 24 (1931), No. 3, pp. 761–768*).—The contributions here presented are as follows: Cotton Boll Weevil Has No Hibernation in Laguna District of Mexico, by C. S. Rude (pp. 761, 762); The Pickle Worm in Chayote in Porto Rico, by F. Sein, jr. (p. 762); The Effect of the Sun on Plum Curculio Larvae in Peach Drops, by O. I. Snapp and J. R. Thomson (pp. 762, 763); The Eggs of the Lima Bean Pod Borer [*Maruca testulalis* Geyer] in Porto Rico, by A. S. Mills and M. D. Leonard (p. 763); Research on Kerosene Extracts of Pyrethrum, by H. H. Richardson (pp. 763, 764); The Euonymus Scale, by P. J. Chapman, M. M. Parker, and G. E. Gould (pp. 674, 675); *Leptoglossus gonagra* Fab. Injuring Citrus in Porto Rico, by M. D. Leonard (pp. 765–767); and Food Preferences of Grasshoppers, by G. A. Mail (pp. 767, 768).

[Contributions on economic insects] (*Ztschr. Angew. Ent., 17 (1930), Nos. 1, pp. 1–194, figs. 72; 2, pp. 227–471, pls. 2, figs. 70; 17 (1931), No. 3, pp. [1]+475–658, figs. 50*).—The contributions here presented (E. S. R., 64, p. 543) are as follows:

No. 1.—Experiments and Investigations on the Epidemiology of the European Corn Borer (*Pyrausta nubilalis* Hbn.) in 1927 and 1928, by A. Hase (pp. 1–52); On the Green Plant Bug *Lygus spinolae* Mey. of the Schilcher Vine in Styria, by L. Fulmek (pp. 53–105), with a bibliography of 36 titles; The Biology and Classification of the European "Black Aphids," with Special Consideration of the Netherlands Species, by C. J. H. Franssen (pp. 106–145), with a list of 23 references; A New *Eriosoma* sp. on the Roots of the Pear (Preliminary Contribution), by O. Jancke (pp. 146–155); Weather and Climate and Their Relation to Insects, by B. P. Uvarov (pp. 156–177), with a list of 39 references to the literature; Some Fundamentals of Insect Epidemiology: An Answer to the Open Letter of Bodenheimer, by E. Janisch (pp. 178–181); The Cerambycid Beetle *Monochamus quadrimaculatus* Motsch. as a Pest of the Siberian Silver

Fir (*Abies sibirica* Led.), by S. S. Prosoroff (pp. 182–184); Fly Larvae (*Meoneura obscurella* Fall.) in Snuff, by E. O. Engel (pp. 184–188); The Causes of Injury by Burning after Treatment with Arsenical Insecticides (pp. 188, 189); On the Knowledge of Immunity in Insects (pp. 189–191); The Most Important Citrus Pests of the Mediterranean Region (pp. 191, 192); The Dependence of the Activity of the Harvest Ant (*Messor semirufus* André) on Temperature and Other Factors (pp. 192, 193); Fumigation with Zyklon against Anobium in the Church of Kefermark, Upper Austria (p. 193); and The Hibernation of Coccinellidae (pp. 193, 194).

No. 2.—Contributions to the Knowledge of the Pest Fauna of Asia Minor—I, Investigations on the Epidemiology of the Grain Bug *Eurygaster integriceps* Put. (Hemipt. Het.), by W. Zwölfer (pp. 227–252), including a list of 41 references to the literature; The Eight-Toothed Larch Bark Beetle *Ips cembrae* Heer: On the Knowledge of Its Biology and Ecology, and of Its Biological Associations, by E. Schimitschek (pp. 253–344), with a list of 56 references to the literature; Studies of the Epidemiology of the European Corn Borer (*Pyrausta nubilalis* Hbn.) in 1927 and 1928, by A. Hase (pp 345–385); On the Attack of Herbarium Plants by the Drug-Store Weevil (*Sitodrepa panicea*), by O. Jancke and L. Lange (pp. 386–403); On the Distribution and Ecology of the Grape Phylloxera in Eastern Europe, by N. N. Troitzky (pp. 404–430); Contributions to the Knowledge of the Ecology and Classification of Leaf Mining Insects, by M. Hering (pp. 431–471).

No. 3.—Studies of the Ecology and Epidemiology of Insects—I, The Pine Noctuid, *Panolis flammea* Schiff., by W. Zwölfer (pp. 475–562); Laboratory Studies of the Bionomy and Control of the Pine Noctuid [*Panolis flammea*], by W. Berwig (pp. 563–586); Studies of the Action of Contact Insecticides on Lepidopterous Larvae, by I. Weis (pp. 587–600); A Contribution to the Knowledge of Parasites of the Pine Geometrid [*Bupalus piniarius*], by P. Steiner (pp. 601–630); and Zoology in Eberswalde—100 Years in Retrospect, by K. Eckstein (pp. 631–658).

Insects and other invertebrates in 1930, R. S. MacDougall (*Highland and Agr. Soc. Trans., 5. ser., 43 (1931), pp. 109–154, figs. 22*).—This account deals with the more important insects of the year and methods for their control.

Damage to lumber caused by insects, J. S. Houser (*Ohio Sta. Bul. 478 (1931), pp. 41–46, fig. 1*).—This contribution, which deals in a general way with preventive practices rather than specific control measures, also discusses a few of the more important insect enemies which damage lumber in Ohio, including the carpenter ants (*Camponotus herculeanus pennsylvanicus* DeG.), termites (*Reticulitermes flavipes* Kol.), and powder post beetles (*Lyctus* spp.).

The transmission of yellow-spot by Thrips tabaci, M. B. Linford (*Pineapple Quart. [Hawaii. Pineapple Canners' Sta.], 1 (1931), No. 2, pp. 53–61, fig. 1*).—Studies of the transmission of pineapple yellow spot by the onion thrips (E. S. R., 65, p. 548) have shown that "larvae from a noninfective colony become infective after feeding upon a diseased plant, but adults reared similarly do not. The virus survives pupation, and insects which feed upon a source of virus while larvae may be infective as adults. There is a period (the incubation period) of approximately 10 days after first feeding upon a diseased plant before thrips transmit infection. A single insect, larva or adult, may transmit the virus to Emilia. The minimum incubation period in *E. sagittata* is about 8 or 9 days, and the mean about 14.6 days. In young pineapple plants the minimum is 7 days and the mean about 12.2 days.

"*T. tabaci* transmits the virus to and recovers it from several other plants in addition to pineapple and Emilia. These are to be considered in a separate paper, together with symptom studies."

Aphid transmission of plant viruses, I. A. Hoggan (*Phytopathology, 20 (1930), No. 1, p. 133*).—The author concludes that while *Myzus pseudosolani* and *Macrosiphum solanifolii* may be factors in the dissemination of ordinary tobacco mosaic on tomato, none of the several aphids studied is likely to be of importance in the dissemination of this disease in tobacco fields.

Studies in mealy bug control, W. Carter (*Pineapple Quart. [Hawaii. Pineapple Canners' Sta.], 1 (1931), No. 2, pp. 94–99*).—The studies here reported are taken up under the headings of disappearance of mealy bugs and possible explanations therefor, edge infestation and mealy bug movement, relation of edge vegetation to infestation, border planting in control measures, location and width of border plantings, effect of border plantings on localizing mealy bug infestation, and field scouting and spraying interval. Data as to mealy bugs on planting material and after planting in an eight-acre block without edge exposure and mealy bug populations in border plantings and in adjoining plantation edges are presented in tabular form.

Carpenter worm injury to ash in North Dakota, J. A. Munro (*Jour. Econ. Ent., 24 (1931), No. 3, pp. 682–685*).—In this contribution from the North Dakota Experiment Station the author reports that the carpenter worm is causing serious injury to the green ash (*Fraxinus lanceolata*) around Fargo, while other species of trees in the vicinity of known infestations do not appear to have been attacked. Notes on the life history and control of the insect are included.

Preliminary notes on the chemistry of codling moth baits, J. R. Eyer and H. Rhodes (*Jour. Econ. Ent., 24 (1931), No. 3, pp. 702–711, pl. 1, figs. 2*).—This is a report of investigations that have been under way at the New Mexico Experiment Station during the past three years and aimed at the determination of the value of attrahent baits as a supplementary measure in the codling moth control problem.

"Chemical analysis of codling moth (*Carpocapsa pomonella*) molasses baits during their periods of maximum attractiveness reveals their attrahent value to be most closely associated with certain changes in the decomposition of the sugars which precedes the formation of alcohol and acetic acid and is first evidenced by a decrease in the glucose content of the baits. These phenomena, which are probably attended by the formation of esters, the exact composition of each of which is as yet undetermined, are of primary importance. The formation of alcohol and the evolution of gas are important secondary factors, while the production of high yeast populations and the conversion of alcohol into acetic acid are only slightly attractive or actually repellent. Under New Mexico conditions, where the average mean daily temperature for the period during which the codling moth adults are most active (May 1 to September 30) is 73.5° F., the effectiveness of molasses baits is actually decreased by adding yeast in commercial form, while on the other hand it is materially increased and the period of attractiveness prolonged by the addition of certain preservatives, particularly benzoate of soda, which delays fermentation.

"A number of commercial esters were tested, and the following are listed in order of their attractiveness: Iso-butyl Phenyl Acetate, Geranyl Formate, Ethyl Oxy-hydrate, Diphenyl Oxide, Citronellal, Bromo Styrol, Methyl Cinnamate. Most of these materials when used alone were not as attractive as plain mollasses baits, and their attractiveness seems to be associated with their chemical composition, boiling point, and characteristic odor."

Orchard spraying for the codling moth (*Nebraska Sta. Rpt.* [*1930*], *p. 22.*)—In a test for arsenic on fruit that had received arsenical spray, the greatest amount found was slightly more than one-half of the so-called world tolerance. Under conditions such as existed, there appears to be no danger from using these sprays. In tests made of the value of paper bands treated with different chemicals for the control of the codling moth, the various treatments resulted in kills ranging from 15 to 96 per cent of the worms that crawled under the bands to hide.

An effort in practical control of codling moth in a Missouri apple district, G. D. JONES (*Jour. Econ. Ent.*, *24* (*1931*), *No. 3, pp. 676–681, figs. 3*).—In this contribution from the Missouri Experiment Station the author reviews the results of three months' cooperative effort against the codling moth in an infested district near Waverly, Mo.

"The cooperation existed between a group of growers whose properties involved a total of over 1,000 acres of bearing apple trees, the Missouri College of Agriculture, and the Missouri Pacific Railway Company. In the season of 1928, the year previous to this effort, the percentage of infested fruit in the district from codling moth at picking time was fairly high. In 1929 at the end of the picking season, in spite of a rainy, cold season which made it impossible to keep a cover of spray material on the fruit and foliage, the growers were agreed that they harvested an increased percentage of clean fruit and that they had been saved the expense of one spray."

Trends in codling moth control in the Pacific Northwest, R. L. WEBSTER (*Jour. Econ. Ent.*, *24* (*1931*), *No. 3, pp. 672–676*).—In this contribution from the Washington College Experiment Station, it is pointed out that the use of lead arsenate and oil sprays for the codling moth in the Pacific Northwest has greatly increased during the past few years, over 4,000,000 lbs. of lead arsenate and 14,000 bbls. of oil spray having been used in the Wenatchee-Okanogan district in 1930. "While a considerable part of the oil was used for dormant treatments, there is a decided tendency toward the use of the oil-lead arsenate combination for codling moth control. The oil-nicotine combination has proved fully as efficient as lead arsenate for the cover sprays in the second brood. It is recommended to replace lead arsenate because of the arsenical residue situation. Codling moth traps are depended upon in the Yakima and Wenatchee Valleys to date cover sprays and have proved very useful in this connection. There are approximately 800 stationary spray plants in the Wenatchee Valley."

Controlling the fruit tree leaf roller (Archips argyrospila) with oil emulsions, G. S. TOLLES (*Jour. Econ. Ent.*, *24* (*1931*), *No. 3, pp. 692–694*).—Several oil sprays were tested in Michigan during the early spring of 1930 to determine their efficiency as ovicides in leaf roller control, including Dendrol 8 per cent, Kleenup 8 per cent, Diamond Paraffin oil emulsified with Kayso using 6 per cent of actual oil, Sunoco spray oil 8 per cent, and Scalecide 8 per cent. All of these were applied during the late dormant period, except Scalecide, applied during the delayed dormant period, and all except Scalecide gave satisfactory control.

Orchard tests following the laboratory tests, in which Dendrol 8 per cent, Kleenup 8 per cent, Diamond Paraffin 6 per cent, and Scalecide 8 per cent were tested, gave practically the same results as the laboratory tests.

Injury to apple trees from the use of calcium cyanide raw linseed oil mixture in controlling the round-headed apple-tree borer, A. B. BURRELL and G. K. PARRIS (*Jour. Econ. Ent.*, *24* (*1931*), *No. 3, pp. 711–716, pl. 1*).—Reports by a few growers in the Champlain Valley fruit section of New York State of severe injury to apple trees from the use of a calcium cyanide-raw

to investigations in which the injury was found to be most severe when the cambium was exposed by cutting out part of the borers before the material was applied, but that from 0.25 to 0.5 in. of cambium beyond the borer tunnel was killed even when no such cutting was done. Preliminary tests indicate that perhaps the use of some oil other than raw linseed will reduce the danger of injury to the tree.

Apple maggot studies in 1930, P. J. Chapman (*Jour. Econ. Ent.*, *24* (*1931*), *No. 3*, *pp. 686–691*, *fig. 1*).—In this contribution three major phases of the apple maggot problem are considered with a view to meeting the requirement imposed by the 1930 restrictions governing apples for export. "These studies include (1) spraying with arsenate of lead to poison the flies, (2) spray residue, and (3) sterilization of fruit after harvest. Cage records indicate that the insect's initial and maximum emergence is about one week later in the Lake Champlain area of New York as compared with the Hudson River Valley. Applications of arsenate of lead about July 5 and July 20 appeared to give good control this season, with an indication that an additional treatment early in August was necessary in certain Lake Champlain Valley orchards. Tests involving 100 bu. of apples and seven varieties show that cold storage at 30 to 33° F. of a month's duration will kill a very high percentage of larvae in harvested fruit."

The toxicity of acid lead arsenate to the larva of the Colorado potato beetle, C. H. Richardson and L. E. Haas (*Jour. Econ. Ent.*, *24* (*1931*), *No. 3*, *pp. 732–736*).—The authors estimate the median lethal dose of acid lead arsenate for the Colorado potato beetle larva of about 0.144 gm. weight to be 0.30 mg. per gram of body weight. The median lethal dose of Paris green was not closely estimated but is evidently less than one-third this amount. The consumption of food by the larva is less and the feeding time is shorter on poisoned than on normal food.

Metabolism of the adult honey bee, M. D. Farrar (*Jour. Econ. Ent.*, *24* (*1931*), *No. 3*, *pp. 611–616*, *pl. 1*, *fig. 1*).—In measurements made to determine the influence of temperature on the rate of metabolism of the adult honeybee, the response to temperature was found to be negative at 0° C., slightly variable at from 14 to 26°, and greatly variable at higher temperatures. The respiratory quotients for all temperatures indicate that the diet of the adult honeybee is composed largely of carbohydrate.

A colony of bees exposed to high external temperatures, W. E. Dunham (*Jour. Econ. Ent.*, *24* (*1931*), *No. 3*, *pp. 606–611*, *pl. 1*, *fig. 1*).—This account includes a discussion of the response of bees when high temperatures occur within the hive and the effect upon hive temperatures following placement of bees in a heat chamber.

The effect of low external temperatures on the brood-nest temperatures of a normal colony of bees during summer, W. E. Dunham (*Jour. Econ. Ent.*, *24* (*1931*), *No. 3*, *pp. 638–643*, *fig. 1*).—This is a report of an experiment conducted with a view to determining the brood-nest temperature of a normal colony of honeybees, when a fairly constant low temperature, below that of the ordinary climatic temperature, was maintained around the hive.

The evaluation of bees for pollination, C. L. Farrar (*Jour. Econ. Ent.*, *24* (*1931*), *No. 3*, *pp. 622–627*).—The data obtained on the number of bees furnished during fruit bloom by overwintered colonies, package bees, and nuclei during two seasons' observations at Amherst, Mass., indicate a pronounced advantage in using properly overwintered colonies.

The present status of honey investigations, E. F. Phillips (*Jour. Econ. Ent.*, *24* (*1931*), *No. 3*, *pp. 581–589*).—A brief sketch is here given of investiga-

tions on honey and of the needs of the future, special emphasis being placed on the need of studies of the physical properties of honey.

Hydrogen-ion concentration of soils and its relation to the importance of white clover as honey plant, E. OERTEL (*Jour. Econ. Ent., 24 (1931), No. 3, pp. 627–632*).—A preliminary study made of the pH values of Louisiana alluvial and upland soils indicates "that there is not a close relationship between soil acidity and white clover growth. The pH value of some upland soils where white clover makes a poor growth is 6.5, while alluvial soils, where white clover grows luxuriantly, have a pH value of 6.5 to 6.7. Many southern soils have a higher pH value than do soils in the so-called 'white clover region' of northeastern United States, but white clover is not generally regarded as a honey plant in the South. Some factor other than available calcium in the soil is probably important in limiting the nectar secretion of white clover."

The effect of temperature on honey in storage, H. F. WILSON and G. E. MARVIN (*Jour. Econ. Ent., 24 (1931), No. 3, pp. 589–597, pls. 2*).—In this contribution from the Wisconsin Experiment Station the authors report that honey can be stored at temperatures below 52° F. with apparent safety, from 52 to 65° being more dangerous than higher or lower temperatures. A constant temperature of 80° is said to be reasonably safe both as to changes in color and fermentation.

Crystallization of honey, E. J. DYCE (*Jour. Econ. Ent., 24 (1931), No. 3, pp. 597–602*).—The physical phenomena of crystal growth and the factors and method of controlling fine crystallization are discussed.

Some comparative data on moisture determination in honey by means of the refractometer and the vacuum drying oven, G. E. MARVIN and H. F. WILSON (*Jour. Econ. Ent., 24 (1931), No. 3, pp. 603, 604*).—Comparative data on sand, glass plate, blotter, asbestos, and refractometer as means for obtaining the moisture content of honey are given in tabular form.

Honey catalase, C. C. GILLETTE (*Jour. Econ. Ent., 24 (1931), No. 3, pp. 605, 606*).—The author finds that catalase is not produced by bees, but that it originates in included pollen grains and arises from fermentation yeasts.

Beekeeping in Missouri, L. HASEMAN (*Missouri Sta. Bul. 305 (1931), pp. 52, figs. 12*).—This practical account replaces an earlier bulletin on farm beekeeping now exhausted (E. S. R., 34, p. 758).

Is Trichogramma becoming a fad? H. S. SMITH and S. E. FLANDERS (*Jour. Econ. Ent., 24 (1931), No. 3, pp. 666–672*).—In this contribution from the California Experiment Station it is pointed out that the control of pests by the use of Trichogramma is a complicated problem, and that until this is fully appreciated there is little prospect of sound conclusions being reached as to its practical value.

ANIMAL PRODUCTION

Methods of determining forage preferences of stock, V. L. CORY (*Ecology, 11 (1930), No. 4, pp. 760–763; abs. in Texas Sta. Circ. 59 (1930), p. 18*).—The author describes in detail the methods used in studying the activities of livestock on the range. The results of the study gained in three years of detailed observations have been previously noted (E. S. R., 58, p. 763).

[Pasture studies at the Middle Tennessee Substation], L. R. NEEL (*Tennessee Sta. Rpt. 1930, pp. 47, 48*).—The results of two studies are noted.

Beef pasture.—Bermuda and white clover pasture plats produced 252 lbs. of beef per acre in 1930 as compared with 498 lbs. in 1929. The difference was attributed to the fact that there was a heavy stand of white clover in 1929 and none in 1930. A mixed pasture consisting mainly of alfalfa, bluegrass, and

some white clover produced a gain of 384 lbs. of beef per acre in 1930 and 349 lbs. of beef in 1929.

Hog pasture.—At weaning time pigs were placed on Sudan grass pasture and given a half feed of a well balanced ration. The pasture was stocked at the rate of 40 pigs per acre for the first 2 months and 20 pigs per acre for 3 months. The pigs consumed 299 lbs. of feed, including corn, tankage, and mineral mixture, per 100 lbs. of gain.

Analyses of commercial feeding stuffs and registrations for 1931, C. S. Cathcart (*New Jersey Stas. Bul. 524 (1931), pp. 82*).—The usual report is given of analyses for protein, fat, and fiber of 1,807 samples of commercial feeding stuffs collected for official inspection during 1930 (E. S. R., 64, p. 62). The principal ingredients in the feed mixtures as determined by microscopic examination are also listed.

The basis of cattle breeding, J. U. Duerst (*Grundlagen der Rinderzucht. Berlin: Julius Springer, 1931, pp. XVI+759, figs. 313*).—In this treatise the author has compiled a lifetime's experience in dealing with the principles and practices of cattle breeding. The physiology of reproduction and the inheritance of general characters are described in detail.

[Experiments with beef cattle in Nebraska] (*Nebraska Sta. Rpt. [1930], pp. 25, 46, 47*).—The results of several experiments, some of which have been continued (E. S. R., 63, p. 657), are reported.

Wintering stock calves in eastern Nebraska.—Calves weighing approximately 350 lbs. per head were fed a wintering ration for 135 days. Calves receiving silage made greater gains and had a better appearance at the end of the test than those fed ground corn fodder. The latter calves, however, had a somewhat higher market value because of their lighter weight. In this test 1 lb. of cottonseed meal was equal to 3 lbs. of alfalfa hay as a protein supplement to either the silage or ground corn fodder rations.

Short-feeding yearling heifers.—Yearling heifers fed for 65 days made large gains and attained sufficient finish to produce satisfactory commercial carcasses. In this work shelled corn was found to be superior to ground ear corn. Feeding ground ear corn with 1 lb. of cottonseed cake per head instead of alfalfa hay caused no digestive disorders, and apparently such a ration was satisfactory, although the gains produced were not as large as when alfalfa hay was fed with ground ear corn.

Beef calves [at the Scottsbluff Substation].—Beef calves carried through a winter feeding period of about 160 days made the cheapest and largest gains on a ration of silage and cottonseed cake, while the most expensive gains were made on alfalfa alone. During the following summer, however, the gains of these cattle were reversed.

Beef cattle [at the Valentine Substation].—In a study of supplemental feeds for wintering range calves, it was found that feeding 2 lbs. of oats compared favorably with feeding 0.75 lb. of cottonseed cake and replacing 30 per cent of the prairie hay with alfalfa returned practically the same profit as the feeding of 1 lb. of cottonseed cake with prairie hay.

The heat production of sheep under varying conditions, E. G. Ritzman and F. G. Benedict (*New Hampshire Sta. Tech. Bul. 45 (1931), pp. 32*).—Continuing this series of studies (E. S. R., 64, p. 369) in cooperation with the Carnegie Institution of Washington, factors influencing metabolism of sheep were investigated. The data collected in this study were obtained by measuring the metabolism of groups of sheep under normal conditions of living during different months of the year to determine the energy needs at different stages of growth and of maturity; from metabolism studies of groups under fasting conditions to determine the length of time after feeding when digestion was

completed, the level of metabolism prevailing at that time, and thus the extent to which this standard condition approaches a basal value and its degree of constancy; and also from the metabolism of single individuals under a more refined control.

Rectal temperatures secured on about 50 sheep at different times showed that for light-wooled yearlings the range was from 39.2 to 40.4° C., for light-wooled adults from 38.8 to 39.7°, and for heavy-wooled adults from 38.9 to 39.7°. The average pulse rate of standing sheep from 7 to 8 hours after being fed was 81 for yearling ewes, 78 for mature ewes, and 74 for mature rams. Fasting apparently tended to reduce the heart action of sheep, for it was found that the average heartbeat of a ram on feed was 80 beats per minute and that the rate dropped to 54 beats 34 hours after feed. Respiratory quotients obtained from aliquot air samples representing periods of from 4 to 7 hours showed that during the course of digestion (from 0 to 10 hours), there was a peak when the quotients were 1 or better, indicating carbohydrate combustion or indirect transformation of carbohydrates to fat. With few exceptions, the fasting quotient was reached between the thirty-fourth and forty-eighth hours after the ingestion of food.

The factors affecting metabolism were divided into two classes, (1) those of an extraneous nature which are intermittent and irregular in their intensity and which directly or indirectly provide for the normal continuance of life and (2) those which are constant and which directly affect either the mechanism of energy production or the conservation of energy. The first group disguises the physiological basal energy requirements, while the second group modifies it.

Under the first group muscular activity and the specific dynamic action of food are the most important factors. Under muscular activity it was found that while animals were standing there was expended an average of 15 per cent more energy than when the animals were lying down. The stimulating effect of the ingestion of food amounted to about a 26 per cent increase over the basal value. The average energy production was hardly 2 per cent lower on the second fasting day than on the first, indicating that the dynamic stimulus of food had practically subsided 24 hours after ingestion.

Among the factors that modify basal metabolism, the effect of age was shown in the previous bulletin. The heat production per square meter of body surface per 24 hours averaged somewhat higher for males than for females. Unsexing males tended to reduce the rate of basal metabolism. The data do not show any influence of oestrum on the metabolism of sheep. During pregnancy there was a tendency toward a gradual lowering in metabolism during the first 3 months, after which it slowly rose again, with a very decided rise about a month before lambing. Lactating ewes showed a higher level of metabolism than dry ewes, but the difference was not large.

In studying the factors affecting heat losses, it was found that sheep are not sensitive to environmental temperatures, probably because of the protection afforded by their fleeces. The fleece served to equalize the variations in temperature of the air over the skin, and when the fleece was shorn the heat production of the animal rose markedly. Huddling or close crowding had little effect on heat production when the animals were on a maintenance ration, but when underfed there was a general tendency toward greater heat production when huddled.

The average daily heat production of sheep made at periods of from 18 to 50 hours after food and while the sheep were lying down was about 1,163 calories.

[Lamb feeding in Nebraska] (*Nebraska Sta. Rpt.* [*1930*], *pp. 26, 27, 28, 29*).—The results of two studies are noted.

Factors affecting the quality and palatability of meat.—Continuing this work (E. S. R., 63, p. 660) along similar lines, a lot of lambs was full-fed shelled corn and alfalfa hay for 140 days, a second lot was full-fed the same ration for 84 days and then a maintenance ration, and a third lot received a maintenance ration of alfalfa hay for 56 days and was then full-fed corn and alfalfa for 84 days. At 28-day intervals, three average lambs from each lot were slaughtered for carcass studies and palatability tests.

In lot 1 the lambs improved from medium to choice during the feeding period, increasing in weight from 64 to 105 lbs. per head and in dressing percentage from 27.5 to 52. In lot 2 the lambs made equal progress during the first 84 days, but while on a maintenance ration the dressing yield decreased about 3 per cent. There were no significant changes in dressing percentage or yield of internal fat for the lambs in lot 3 during the maintenance period, but later their behavior was similar to the other lots. Carcass studies showed that with increased fatness the weight of loins increased, due to the accumulation of kidney fat, and the percentage of bone in the shortracks decreased from 20 per cent in the controls to 12 per cent in the lambs full-fed for 140 days. As the feeding period progressed the percentage of fat in the tissues increased with a corresponding decrease in percentages of water, protein, and ash. Palatability studies showed that the aroma of fat roasts was more pronounced and more desirable, the flavor of the fat more desirable, and the flavor of the lean less marked and more desirable. Fat roasts were more tender and juicy than leaner roasts.

Lamb feeding.—In this test two lots of 75 lambs each, averaging 63 lbs. per head, were used. Lot 1 was full-fed shelled corn and alfalfa hay for 84 days, at which time all but 20 of the lambs were marketed. One half of the remaining lambs were continued on full feed and the other half on a limited grain ration. Those on full feed made an average gain of 42.4 lbs. per head for 140 days, and required 19 per cent more corn and 32 per cent more alfalfa per unit of gain during the last 56 days than during the first 84 days. Trying to maintain the weight of lambs that had been on a full feed was not entirely satisfactory. The lambs in lot 2 were fed alfalfa only for 56 days and then full-fed corn and alfalfa. While these lambs remained thrifty during the early part of the feeding period, they made little gain. However, during the whole period the gains were similar to those in lot 1, but slightly more corn and considerably more hay were required to make these gains.

A second phase of this study was to determine the effect of the plane of nutrition on wool and body growth. A lot of six Shropshire lambs received a maintenance ration of alfalfa meal, while a similar lot was full-fed cracked corn and alfalfa meal. During the feeding period lot 1 lost weight, while lot 2 made good gains in body weight. The total wool secured and the breaking strength of the fibers were decreased when the lambs were on a low plane of nutrition for 196 days.

Alfalfa molasses meal for fattening lambs, A. D. Weber and H. D. Fox (*Nebraska Sta. Bul. 259 (1931), pp. 12, fig. 1*).—Concluding this series of studies (E. S. R., 59, p. 866), a comparison was made of alfalfa hay, alfalfa meal, alfalfa molasses meal containing 30 per cent of beet molasses, and alfalfa molasses meal containing 30 per cent of cane molasses when fed with corn to fattening lambs. Comparisons were also made of alfalfa molasses meals containing 20, 30, and 40 per cent of molasses and also of shelled corn and cracked corn.

Lambs receiving alfalfa meal or alfalfa molasses meal were kept on feed more easily, ate more grain, and made larger and more economical gains than those receiving alfalfa hay. When lambs were receiving as much corn as they

would consume, alfalfa meal and alfalfa molasses meal had approximately the same feeding value. When comprising 30 per cent of an alfalfa molasses meal, beet and cane molasses were of equal value. Feeding alfalfa molasses meals containing 20, 30, and 40 per cent of beet molasses caused no significant differences in the rate or economy of gains. Lambs fed cracked corn ate more feed and made larger gains than those fed shelled corn. This was due to the fact that when shelled corn was fed the lambs picked out the grain and left the roughage until last, while when cracked corn was fed the lambs were forced to eat the roughage along with the grain.

There appeared to be a definite correlation between the opportunity afforded greedy lambs to overeat grain and death losses. In the alfalfa hay lots the death loss was 12.7 per cent, in the lots receiving shelled corn mixed with alfalfa meal or alfalfa molasses meal 3.4 per cent, and in the lots receiving cracked corn mixed with alfalfa meal or alfalfa molasses meal 0.7 per cent.

[Experiments with swine in Nebraska] (*Nebraska Sta. Rpt. [1930], pp. 25, 26, 27, 28*).—Continuing work previously noted (E. S. R., 63, p. 660), three studies are reported.

Forage crops for hogs.—In this study 6 lots of 10 pigs each were used, the last 5 of which were on Sudan grass pasture. In addition the respective lots received corn and tankage (dry lot); corn and tankage; corn; ground wheat and tankage; whole wheat and tankage; and ground barley and tankage. The average daily gains in the respective lots were 0.59, 1, 0.8, 1.16, 0.99, and 0.98 lb. per head. The most expensive gains were produced in lot 1 and the least expensive in lot 2. In this test ground wheat was 98 per cent and ground barley 84 per cent as efficient as shelled corn for feeding hogs.

Rations for fattening hogs.—In this test 3 lots of 10 pigs each, averaging 71.6 lbs. per head, were fed from January 1 to June 9 in an effort to determine the effect of the weight of pigs on the rate and economy of gains. The ration fed consisted of corn and a mixture of tankage, cottonseed meal, and ground alfalfa hay 2 : 1 : 1, both self-fed. The pigs were fed to an average final weight of 350 lbs. Feed consumption was checked at average weights of 100 and 150 lbs. per head and at 25-lb. intervals thereafter. The feed required to produce a unit of gain increased up to 200 lbs., but there appeared to be a slight decrease in these requirements during the next period. However, this decrease was not evident in the final feeding period.

Factors affecting the quality and palatability of meat.—When the pigs in the above experiment reached an average weight of 150 lbs. and at 25-lb. intervals thereafter to 250 lbs., three average animals were slaughtered. From 250 to 400 lbs.' weight, average animals were slaughtered at 50-lb. intervals. The dressing percentage increased from 73.2 at 150 lbs. to 82.7 at 400 lbs. The fat cuts increased, while the lean cuts decreased from 2 to 4 per cent, as the pigs increased in weight. The back fat averaged 0.6 in. thick at 150 lbs. and 2.35 in. at 400 lbs. The percentage of bone decreased from 10.63 in a 150-lb. pig to 6.25 in a 400-lb. pig. The mechanically separable fat and lean averaged 28 and 53 per cent, respectively, in the 150-lb. pig, and 58 and 30 per cent, respectively, in the 400-lb. pig. Chemical analyses showed that the percentages of water, protein, and ash in the edible portion of pork loins decreased with increased fatness. Pork roasts lost a higher percentage of drippings as they increased in fatness, while progressive fatness increased the amount and richness of the juice and the desirability of the fat flavor.

[Swine studies in New Jersey] (*New Jersey Stas. Rpt. 1930, pp. 24–26*).—Continuing this study in cooperation with the U. S. D. A. Bureau of Animal Industry (E. S. R., 61, p. 761), 2 lots of 10 pigs each were placed on test December 20, but due to sickness it was necessary to remove some animals so

that at the close of the test on May 15 only 5 pigs remained in lot 1 and 6 in lot 2. The ration fed lot 1 consisted of 8 parts of ground corn, 1 part of tankage, 5 per cent of alfalfa meal, and 2 per cent of mineral mixture, self-fed to 100 lbs. of live weight. From this time until the pigs reached an approximate final weight of 225 lbs. the ration consisted of 12 parts of ground corn, 1 part of tankage, and 2 per cent of minerals. The ration fed lot 2 was similar to the above except that Maine fish meal was substituted for the tankage.

The pigs in lot 1 made a total gain of 924 lbs. and consumed 3,783.66 lbs. of feed, or 409.48 lbs. of feed per 100 lbs. of gain. The pigs in lot 2 gained 1,107 lbs., consuming a total of 4,141.91 lbs. of feed, or 374.15 lbs. of feed for each 100 lbs. of gain. At the prices charged for feed, 100 lbs. of gain cost $10.03 in lot 1 and $9.09 in lot 2.

Preparation of oats and barley for pigs, A. W. OLIVER (*Oregon Sta. Circ. 104 (1931), pp. 7*).—Concluding this series of studies (E. S. R., 64, p. 370) on the preparation of grain for hogs, it was shown that 100 lbs. each of whole oats soaked, coarsely ground oats, finely ground oats, and steam-rolled oats were equal to 99.62, 103.62, 112.7, and 97.58 lbs. respectively, of whole dry oats. It was also proved that 100 lbs. each of whole barley soaked, coarsely ground barley, finely ground barley, and steam-rolled barley were equal to 90.12, 109.6, 113.1, and 116.5 lbs., respectively, of whole dry barley.

The costs of the various methods of preparation are given in tabular form.

Meat-curing, L. R. NEEL (*Tennessee Sta. Rpt. 1930, p. 48*).—The results of a meat-curing study have shown the superiority of sugar-cured hams and bacon over plain salt-cured meat. The cure used for hams consisted of 7.5 lbs. of salt, 2.5 lbs. of sugar, and 2 oz. of saltpeter per 100 lbs. of meat. This cure was applied in three parts, the first of which was put on after the meat had cooled and was trimmed, the second part 48 hours later, and the third part 6 days from the time of the first application. The meat was left in the cure 1.5 days for each pound of the piece. For bacon the cure consisted of 4 lbs. of salt, 2.5 lbs. of sugar, and 5 oz. of saltpeter per 100 lbs. of meat. Half of the mixture was rubbed on the flesh side of the bacon when the meat had cooled and the remainder in 3 or 4 days. The bacon was left in the cure for 2 weeks. Shrinkage of hams averaged 22 per cent and of bacon 18 per cent during a 10-months period.

Miscellaneous feeding trials with poultry, G. D. QUIGLEY and R. H. WAITE (*Maryland Sta. Bul. 325 (1931), pp. 343–361, fig. 1*).—The results of three studies are reported in this bulletin.

I. *The effects of corn cockle on poultry.*—In this experiment an effort was made to determine the palatability of whole cockle seed to chickens; the effect of feeding various amounts of ground cockle, both pure and with other grains, and an aqueous solution; the effect of various percentages of ground cockle on the consumption of dry mash; and the toxic and lethal doses.

The whole seed proved to be very unpalatable, and it appeared unlikely that a normal fowl would eat it. Poultry were found to vary considerably in their individual resistance to the effects of cockle. The toxic effect of the seed was reduced to a considerable extent when used in ground grain mixtures. As little as 1 per cent, or even 0.5 per cent, of ground cockle seed in a mash adversely affected its palatability, but the cockle had little effect on gain or loss in body weight unless it was present in a mash in amounts exceeding 1 per cent of dry weight. Continued feeding of cockle appeared to develop a tolerance from the standpoint of both palatability and physiological effect, although palatability continued to be adversely affected in amounts of 5 per cent or more in the dry

mash. A toxic dose of cockle was approximately 0.2 per cent of the body weight. The following characteristics were found typical upon post-mortem examination of birds receiving lethal doses of pure cockle: A yellow, caseous or cheesy lining to the crop, the presence of an amber gelatinous exudate next to the outer muscular coat of the crop, a collection of similar material within the pericardium of the heart, hemorrhages or congested areas in the fatty portion of the heart, a clear fluid surrounding the intestine, and some congestion in lungs and trachea.

II. *Smut damaged wheat for poultry.*—In an effort to determine what, if any, would be the effect when wheat damaged by stinking smut was fed to chickens, 2 lots of 4 birds each were used. Lot 1 was fed smutty wheat for 6 days, and lot 2 received clean wheat for a similar period. The rations were then reversed for an additional 6-day period. During the first period lot 1 consumed 3.94 lbs. of smutty wheat and lost 0.72 lb. in body weight, while during the second period the birds consumed 3.92 lbs. of clean wheat and gained 0.27 lb. in body weight. The corresponding figures for lot 2 were 4.39 lbs. consumed and 0.6 lb. gained for period 1, and 5.1 lbs. consumed and 0.5 lb. gained for period 2. These results indicate that smutty wheat was fairly satisfactory for poultry from the standpoint of palatability and lack of deleterious effect, although its feeding value was somewhat reduced due to the destructive action of the smut.

III. *Results of trials with feeds suspected of having caused mortality in Maryland flocks.*—In cooperation with L. E. Bopst, a number of samples of feeds were tested which were suspected by farmers and poultrymen of having caused either physical derangement or actual mortality in their flocks. The usual plan for such tests was to select healthy birds from the station flock of an age corresponding with the age of the birds in the flock from which the complaint was received. The birds were placed under observation for from 10 to 24 hours without feed, and were then fed the suspected feed as the entire ration for 7 days or until the entire sample was consumed. None of the feeds tested killed the healthy birds, and only two samples produced intestinal disturbances. The kind of feed, number of birds tested, and mortality record are given in tabular form.

[Experiments with poultry in Nebraska] (*Nebraska Sta. Rpt. [1930], pp. 38, 39*).—The results of two studies, both of which have been continued (E. S. R., 63, p. 665), are noted.

Nutrition studies of growing chicks.—Continuing this work, it was found that autoclaved yeast stimulated the growth of chicks as effectively as did the original yeast. Since autoclaving for 2 hours at 15 lbs. pressure is known to destroy the antirachitic vitamin factor, these results show that the increase in growth rate was not due to the vitamin B_1 contribution.

Turkey production.—In one phase of this study there was no evidence to indicate that mating Bronze females with White Holland or Bourbon males stimulated the growth rate of turkeys. At 24 weeks of age standard-bred Bronze males weighed 1.61 times as much as females.

In a second phase of this project, 150 turkey eggs of apparently the same shell texture and quality and of the same size were incubated in the same cabinet incubator with temperature, humidity, and ventilation controlled. Accurate weights were obtained on each egg at the beginning and at the end of 8, 16, and 24 days. The mean weight loss from the first to the twenty-fourth day was 11.95 per cent of the original weight. The individual loss of eggs was from 9 to 16.9 per cent under the same humidity conditions.

Utilization of proteins by the growing chick, F. E. Mussehl and C. W. Ackerson (*Nebraska Sta. Research Bul. 55 (1931), pp. 19, figs. 5*).—In an effort

to determine the nutritive value of proteins from different sources for growing chicks, a series of five experiments was undertaken. The chicks were brooded for 7 days and then selected for vigor and normality, and were also weighed at the beginning of the test, at the end of 4 weeks, and at the end of 8 weeks. The difference in growth rate of sexes was corrected by the method previously noted (E. S. R., 63, p. 471). Meat and bone meal was used in all tests as a standard with which the other concentrates were compared. In the first three experiments there were six lots of 30, 27, and 35 chicks each, respectively, in the fourth experiment seven lots of 33 chicks each, and in the fifth experiment three lots of 66 chicks each.

The results showed a marked difference in the nutritive value of the various protein concentrates when used to supplement a corn-wheat basal ration complete for known vitamin and mineral requirements. A marked difference in biological value was also found in the animal protein concentrates. While a precise evaluation of the nutritive value of the concentrates was not possible, a fair interpretation was made possible by the use of a letter system for indicating values, using *AA* to represent the highest value, *A* the next grade, *BB* the next, etc. According to the above system, the concentrates used in these studies were evaluated as follows: Dried buttermilk, *AA;* fish meal, *AA;* casein, *AA;* meat and bone meal, *A;* soybean meal, *A;* blood meal, *B;* cottonseed meal, *B;* linseed meal, *C;* corn gluten meal, *C;* and gelatin, *D*.

Soybean meal proved to be the most valuable of the plant concentrates used for promoting growth, and cottonseed meal was superior to linseed meal. The supplementing values of protein concentrates, one to another, were not as evident in these experiments as would be expected from the usual theory of protein utilization.

[Poultry studies in New Jersey] (*New Jersey Stas. Rpt. 1930, p. 52.*)—A study of a year's egg weight records of 717 Single Comb White Leghorn hens indicated that the size of eggs laid by individual birds varied widely during the year. There was no correlation between the number of eggs laid and the percentage of first grade eggs. The capacity to produce a large percentage of first grade eggs was apparently inherited entirely separately from the capacity to produce a certain number of eggs. From a study of the egg weight records of 400 Single Comb White Leghorn pullets, it was found that the percentage of first grade eggs produced during March, April, and May was a good indicator of the percentage of such eggs laid during the entire year.

[Nutrition studies in New Jersey] (*New Jersey Stas. Rpt. 1930, pp. 10, 11*).—Continuing these studies (E. S. R., 63, p. 365), an attempt was made to study the effect of feeding a vitamin A-deficient ration on the nonprotein nitrogen, uric acid, urea, creatine-creatinine, and sugar constituents of the blood of pullets. During a 10-weeks period there were no outward symptoms of vitamin A deficiency, and there were no changes of the above-named constituents from the normal. Even after 4.5 months' feeding there were no outward indications of the deficiency. Day-old chicks on a vitamin A-deficient ration showed definite signs of the deficiency in 2.5 weeks. The uric acid of the blood of these chicks showed in some cases an increase of 15 mg., but was usually not more than 2 mg. above normal. Post-mortem examinations revealed the presence of urates in the ureters in some cases. The chicks on vitamin A-deficient rations failed to develop yellow pigmentation of the legs, and the secondary sex characters were underdeveloped.

A histological study of the connective tissue of the gastrocnemius muscle of rachitic and normal rats showed no difference in the amount or character of the connective tissue.

A group of hens receiving a basal ration deficient in the antirachitic factor had a much lower egg production and the hatchability of their eggs was markedly lower than in the case of hens receiving daylight through Cel-O-Glass or 2 per cent of cod-liver oil in the basal ration. Adding irradiated ergosterol to the basal ration did not cause production to be as high as in the lots receiving cod-liver oil or sunlight through the glass substitute, although the production was slightly better than that of the basal ration group. The hatchability of the eggs from the hens fed ergosterol was only slightly better than that of the basal ration group. The egg production of a group of pullets receiving ergosterol was not as good as that of the Cel-O-Glass or cod-liver oil groups of hens.

DAIRY FARMING—DAIRYING

Handbook of dairy science, Vol. I, Pt. I, edited by W. Winkler et al. (*Handbuch der Milchwirtschaft. Vienna: Julius Springer, 1930, vol. 1, pt. 1, pp. X+413, figs. [61]*).—This is the first part of volume 1 of this treatise dealing with the composition and nature of milk, the microbiology of milk, variations in milk, and the testing of milk.

Australian dairyman's handbook, R. S. Maynard (*Sydney: Angus & Robertson, 1931, pp. XX+687, pls. 43, figs. 146*).—In this treatise the author discusses the general phases of management, breeding, and feeding that relate to the dairy industry in Australia. In addition, pork production as a side line to dairying is also discussed.

[Experiments with dairy cattle in New Jersey], J. W. Bartlett (*New Jersey Stas. Rpt. 1930, pp. 30, 31, 106–117*).—The results of several studies in continuation of those previously noted (E. S. R., 63, p. 366) are reported.

The use of colloidal iodine in the nutrition of dairy calves.—Several calves were fed a 5 per cent solution of colloidal iodine in amounts from 5 to 20 cc., added to the whole milk at each feeding. During the test the calves became infected with *Bacillus actinoides.* The affected animals ran a high temperature, drooped about the ears, had a heavy nasal discharge, and coughed for at least 2 months, but in spite of the ailment continued to make normal gains for the breed. The iodine stimulated appetites, and in one case a 6-weeks-old calf was able to consume 16 lbs. of whole milk without digestive disturbance. All the calves received 10 lbs. of whole milk daily, and during the 165-day test made average daily gains varying from 0.77 for a Jersey to 1.55 lbs. for a Holstein. The skeletal growth of the animals was above normal, but in all cases there appeared to be a lack of body flesh. However, when taken off milk and iodine and put on grain and alfalfa hay the calves made rapid gains in weight and became normal in flesh.

The use of Klip as a fly repellent for milking cows.—A comparison of spraying v. not spraying cows with Klip during 4 alternate 14-day periods indicated that it is economical to spray cows as a protection against flies. During the period when the cows were not sprayed, milk production fell off and some cows were so annoyed by the flies that the fat percentage of their milk decreased.

Effect of nitrogen fertilization on protein content of corn and feeding value of the whole plant when ensiled, C. B. Bender.—Continuing this study, the fertilizer treatment was the same as previously noted (E. S. R., 61, p. 765). The carrying capacity of each of the 7 plats during the 165-day pasture season was 1.432, 1.172, 1.14, 1.205, 1.347, 0.85, and 0.9 cows, respectively. From May 4 to June 9, 19 milking cows were placed on plats 5, 4, 6, and 2, and were fed no hay or silage, but received grain at the rate of 1 lb. to 3.485 lbs. of milk

produced. The average daily milk production while on these respective plats was 26.99, 23.69, 21.4, and 21.6 lbs. The yearling heifers gained 1.09 lbs. daily during the pasture season and also gained 4.4 cm. in height at withers.

The effect of cod-liver oil on growth when fed in combination with dry grain mixtures to calves taken off milk when 30 days old.—A basal ration composed of yellow corn meal, ground oats, wheat bran, linseed meal, and minerals was fed to two groups of calves up to 6 months of age. In addition one group received soluble blood flour and the other group fish meal. Half of the calves in each group were fed 20 cc. of cod-liver oil per head daily, while the others were kept as checks. In the group receiving blood flour there was no apparent beneficial effect from feeding cod-liver oil, but in the group receiving fish meal there was a difference of 14 lbs. in the average weight of the calves fed cod-liver oil.

Use of fish meal as a component of a dry grain feed for raising calves taken off milk at 30 days of age.—A group of 5 calves fed for 180 days on a ration containing 12.5 parts of fish meal (vacuum process) did not make normal growth in either weight or height.

The effect of substituting 10 per cent of Manamar for linseed oil meal in the ration of growing heifers.—Substituting Manamar for part of the linseed meal in the ration of 11 8-months-old heifers did not result in an increase in weight, but the animals receiving Manamar appeared to have sleeker hair coats.

Winter feeding of heifers.—A group of 9 heifers fed an all-roughage ration during the winter made an average daily gain of 0.68 lb. per head as compared with a gain of 1.2 lbs. per head for a similar group fed roughage plus 2.5 lbs. of cottonseed meal daily. During the pasture season the heifers that had been fed roughage only gained at the rate of 0.85 lb. per head daily, while those that had received roughage and cottonseed meal made an average daily gain of 0.87 lb. per head.

The principles of dairying: Testing and manufactures, H. F. Judkins, rev. by R. W. Smith, jr. (*New York: John Wiley & Sons; London: Chapman & Hall, 1931, 2. ed., rev., pp. XVII+322, figs. 86*).—The junior author has revised and enlarged this edition of the treatise previously noted (E. S. R., 52, p. 174).

Nineteenth annual report of the International Association of Dairy and Milk Inspectors, compiled by P. B. Brooks (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt., 19 (1930), pp. 300, pls. 2, figs. 30*).—The usual report of the annual meeting (E. S. R., 64, p. 70), held at Cleveland, Ohio, October 22–24, 1930, includes the following papers: Report of Committee on Communicable Diseases Affecting Man, Their Relation to Public Milk Supplies, by H. N. Parker (pp. 59–67); The Colon Group of Bacteria in Milk, by E. K. Kline (pp. 68–85); Undulant Fever, by H. E. Hasseltine (pp. 85–92); Report of Committee on Milk Plant Practice, by H. A. Harding (pp. 94–99); Report of Committee on Dairy and Milk Plant Equipment, by G. W. Putnam (pp. 101, 103); Activities of the International Association of Milk Dealers of Interest to the Dairy and Milk Inspector, by W. H. Marcussen (pp. 103–117); Milk Cans and Can Washing, by W. B. Palmer (pp. 119–129); Some Bacteriological and Temperature Studies in Milk Plants, by C. S. Leete (pp. 129–135); Observations on Effects of Thermophilic Bacteria in Pasteurized Milk, by H. A. Harding and A. R. Ward (pp. 135–143); A Survey of the New York State Milk and Cream Supply, by W. D. Tiedeman (pp. 143–150); Cooperation between the Ice Cream Manufacturers and the Official Inspectors, by F. Rasmussen (pp. 152–159); The "What and How" of Ice Cream and Milk Plant Inspection, by H. F. Judkins (pp. 169–180); Judging the Quality of Milk and Cream by the Micro-

scopic Count of Bacteria for the Milk Distributor and Ice Cream Manufacturer, by R. S. Breed (pp. 185–212); Report of Committee on Sanitary Control of Ice Cream, by R. E. Irwin (p. 216); Report of Committee on Public Relations, by G. W. Grim (pp. 216–219); Report of Committee on Dairy Farm Methods, by T. J. Strauch (pp. 219–223); Higher Milk Standards, by R. F. Leslie (pp. 223–227); Grade A Milk from Farm to Table, by A. D. Burke and I. M. Cox (pp. 229–234); Farm Sterilization of Dairy Utensils by Hypochlorite, by C. K. Johns (pp. 236–244); The Status of Flavors in Milk, by C. L. Roadhouse (pp. 246–253); Cooperation in Quality Improvement of Milk Supplies, by C. I. Cohee (pp. 254–260); Report of Committee on Milk Ordinances, by W. B. Palmer (pp. 261–266); Some Present Opportunities for the Dairy Industry, by R. W. Balderston (pp. 267–270); A Modified Methylene Blue Reduction Test, by C. K. Johns (pp. 272–282); Time and Temperature Test of Keeping Quality of Milk, by H. G. Harding (pp. 282–287); and Brief Notes on Laboratory Incubator Temperatures, by F. L. Mickle (pp. 288–300).

A study of the influence of fatty acids and their triglycerides on the processing of dairy products, F. C. Button (*New Jersey Stas. Rpt. 1930, pp. 118, 119*).—Continuing this study (E. S. R., 63, p. 368), it was found that the triglycerides of stearic, oleic, and ricinoleic acids were in all cases less effective than their fatty acids in aiding overrun of ice cream mixes. Stearic acid caused the greatest increase in overrun and ricinoleic acid was almost as effective, but oleic acid did not affect the overrun values over those obtained with check mixes. Triricinolein produced a slight increase in overrun, tristearin was ineffective, and triolein was detrimental to overrun.

Preliminary studies have shown that the construction of the churn and the action of the beater in the churn are of great importance in butter making, since products of small specific gravity are acted on more rigorously than heavier substances. Churns equipped with beaters caused rapid mixing of the added ingredients, rapid construction of a foam, and a constant destruction of the foam nearest the beater. With this type of churn butter was formed only after water drained from the foam structure and the structure itself was destroyed. In this study it was found that dairy products with the ingredients of egg origin and of the fatty series all caused more rapid production of butter than check dairy products.

Adding the same ingredients to the different types of dairy products and shaking them in a swinging churn showed that none of the added ingredients caused more rapid churning than dairy products containing no foreign substance. Foam formation and hence butter formation was inhibited more by some ingredients than others, and not aided by any.

The creaming of milk pasteurized at high temperatures, J. C. Marquardt and A. C. Dahlberg (*New York State Sta. Tech. Bul. 180 (1931), pp. 26, figs. 4*).—Extending the studies previously noted (E. S. R., 62, p. 769), a series of lots of mixed herd milk were heated by an internal tubular heater to temperatures ranging from 150 to 165° F. for periods ranging from less than 10 seconds to more than 5 minutes. The milks were judged for flavor and set for cream layer determination. The time required for the milk to pass through the heater and the temperature of the milk in the tubes varied slightly.

Milk was shown to exhibit a heat induction period, a period during which milk could be subjected to heat before the temperature began to affect the creaming properties. This period varied considerably with different lots of milk. The differences in the cream layer volumes were more marked at the 2- and 4-hour readings, but the same trend in results was always secured at the 24-hour readings. The fat content of the cream decreased with increased temperature or time of pasteurization, and the reduction in the cream layer vol-

ume from excessive heat was due to the failure of the fat to rise in the cream layer.

In discussing this work it is emphasized that internal tubular high temperature heaters should be equipped with at least two units, the first preheating milk to about 142° and the second heating the milk rapidly to the final temperature in order to reduce to a minimum the time required to reach that temperature.

Investigations on the consistency of Swedish butter [trans. title], E. HAGLUND G. WODE, and T. OLSSON (*K. Landtbr. Akad. Handl. och Tidskr., 69 (1930), No. 8, pp. 1147–1172, figs. 4*).—In an effort to determine the consistency of Swedish butter at different times of the year and in various districts and to ascertain the factors influencing this consistency, 413 samples of butter from the south and middle of Sweden were tested. The butter samples were kept in a water thermostat at 15° C. (59° F.) for 24 hours, after which the hardness of the samples was determined. Other samples were taken during churning tests at the dairy department of the Central Agricultural Experiment Station and were kept in ice water for 7, 14, and 30 days, after which the temperature was raised to 15° and the hardness determined.

The results showed that the hardness of the butter varied with the season of the year and with the source of the butterfat. These variations were due to differences in the iodine value for the fat, the result of different methods of feeding. The hardness of the butter decreased as the iodine value for the fat increased, but it was also found that fat with a certain iodine value could yield butter of varying degrees of hardness.

The churning tests showed that permanent variations in the hardness of butter could be produced by the method of making the butter. It was shown that long and intense cooling of the cream before churning increased the hardness, while long and intense cooling of the butter granules before working decreased the hardness of the butter.

How to make sweet curd-cottage cheese, P. H. TRACY (*Milk Dealer, 20 (1931), No. 5, pp. 53–55, fig. 1*).—In this paper from the Illinois Experiment Station the method for the manufacture of sweet curd cottage cheese is described. The causes of tough and rather rubbery curd and of soft pasty curd are discussed.

The subsequent development of gas in Gouda cheese [trans. title], F. W. J. BOEKHOUT and J. VAN BEYNUM (*Ver. Exploit. Proefzuivelboerderij Hoorn, Verslag 1928, pp. 1–18, pls. 8, fig. 1; Eng. abs., pp. 17, 18*).—In a study of the formation of gas in the interior of Gouda cheese later than 2 weeks after salting, known as "subsequent blowing," the agricultural experiment station at Hoorn, Netherlands, found the trouble to be due to butyric acid bacteria. These bacteria would not produce fermentation in a peptone-calcium lactate medium when inoculated with pure cultures but always produced fermentation when inoculated with cheese. In a medium in which beef broth was substituted for the peptone a precipitation of insoluble calcium phosphates produced a high acidity. During the neutralization of the acids in the culture medium, the hydrogen-ion concentration of the calcium lactate was decreased, due to the breaking down of the lactate into calcium butyrate and calcium carbonate.

In order to prove the above observations, some series of cheeses were made with pure milk. In each series four cheeses were used, two of which were inoculated with butyric acid bacteria and two were used as controls. Three strains of bacteria were used and all produced gas, while no gas was formed in the control cheeses. In the inoculated cheeses the greater salt concentration at the sides prevented gas formation, and there was a great difference in the

acidity at the middle and sides of the inoculated cheeses. In the control cheeses this difference in acidity was not observed or was very small.

Sharp vs. dull ice cream freezer blades and freezing efficiency, R. C. MUNKWITZ and DEV. MEADE (*Maryland Sta. Bul. 324* (*1931*), *pp. 327–342, figs. 13*).—While it was realized that many factors might affect the results secured in a study of this type, in order to avoid these variables uniform plant conditions, with but two exceptions, were maintained. During part of the experiment only vanilla cream was frozen, and during the whole experiment the machine was not run unless it contained a mix. Samples of vanilla ice cream were run into paper tubes when the mix reached an 80 per cent overrun, when the freezer was half empty, and at the end of the run. Check samples were taken from the load immediately following the run. These samples were placed in the hardening room for at least 48 hours, when the cream column was broken, the broken surface thoroughly hardened with the aid of dry ice, and a photograph taken of the exposed surface.

This study showed that motor efficiency decreased as dullness of freezer blades increased. The degree of dullness of the blades had an adverse effect on freezing time, extreme dullness often increasing freezing time more than 100 per cent. The cross section photographs of the finished ice cream showed that dull freezer blades caused coarseness. This coarseness was evident in the photographs when only slight dullness of the blades was visible. The dullness of the blades was indicated by increased freezing time, vibrations on the Draw-Rite charts, increased pull on the motor, and coarseness of the finished product.

It was shown that running the freezer empty, while washing, or while freezing ices increased the wear on the blades.

VETERINARY MEDICINE

[Contributions on animal pathology] (*Arch. Wiss. u. Prakt. Tierheilk., 58* (*1928*), *Nos. 1, pp. 116, pl. 1, figs. 12; 2, pp. 117–210, figs. 5; 3, pp. 213–310, figs. 9; 4, pp. 313–425, figs. 17; 5, pp. 429–537, figs.* [*28*]; *6, pp. 541–660, figs. 59*).—The contributions here presented are as follows: Investigations of the Disturbance of Secretion of the Udder, Particularly That Resulting from Streptococcic Mastitis, by M. Seelemann (pp. 1–53), including a list of 47 references to the literature; The Blood Picture of Moribund Horses, by U. Bürger (pp. 54–67); Tests with Certain Disinfectants upon the Virus of Foot-and-Mouth Disease and the Fowl Cholera Bacillus, I, by R. Heim and W. Wedemann (pp. 68–94) (E. S. R., 61, p. 470); Experimental Disinfection of Foot-and-Mouth Disease with Sulfurous Acid as well as with a Solution of Caustic Soda, by K. Trautwein and K. Reppin (pp. 95–112); The H-ion Concentration of the Bile of Cattle, Dogs, and the Fowl, by F. Müller (pp. 113–116); Hemorrhagic Septicemia in the District of Osterode, East Prussia, by Migge (pp. 117–137); The Infectivity of the Urine, Feces, Bile, and Milk of Animals Affected with Foot-and-Mouth Disease, by K. Trautwein, E. Thomashoff, and K. R. Höve (pp. 138–171); On the Action of Gynergen and Adrenaline on the Gravid Bovine Uterus, by H. Graf and A. Nimtz (pp. 172–179), including a list of 30 references to the literature; Contribution to the Knowledge of the Patho-anatomical Changes of the Lungs in Infectious Diseases of Swine, by Van Diermen (pp. 180–188); The Blood Picture of Sound and Tubercular Cattle by F. Basel and G. Lewek (pp. 189–194); Siburiak of Horses in the Government of Uralsk by N. Q. Wertjatschkin (pp. 195–197); Titration and Ion acidity of the stomach content of Dogs Fed on Different Foods, by F. Nagi (pp. 198–208); Foot-and-Mouth Disease Disinfection with Sulfoliquid, by

K. Trautwein (pp. 204–210); Investigations of the Serological Diagnosis of Tuberculosis of the Bovine—I, Is the Complement Fixation Reaction Specific? (pp. 213–221) and II, The Functional Capacity of Serological Methods (pp. 222–246), both by K. Beller, with a bibliography of 53 titles; Pus and Pus Removal and Its Hygienic Importance in the Control of Foot-and-Mouth Disease, by K. Wagener (pp. 247–268); The Neukla Ophthalmoscope, by K. Neumann-Kleinpaul (pp. 269, 270); The Antagonism of Pilocarpine and Atropine on the Gravid Uterus of the Bovine, by H. Graf and W. Gradel (pp. 271–280); Calcium and Albumen in the Urine of Cattle Fed Hay from the Spreewald District with a Supplement of Vitakalk, by H. Heisig (p. 281–287); Investigations of the H-ion Concentration and the Ferment Content of Liquor Amnii of Some Domestic Animals, by F. Krynedl and H. Ullrich (pp. 288–295); Inoculation Experiments with Guinea Pigs and Feeding Experiments with Swine to Test the Reliability of Pasteurizing Milk at from 63 to 65° C. for 30 Minutes, I, II, by O. Pröscholdt (pp. 296–310, 313–322); The Blood Picture of Tubercular Cattle, by F. Basel and G. Lewek (pp. 323–346); Methods of Cultivation in Bacteriologic Meat Inspection, by H. Rastaedt (pp. 347–356); An Outbreak of Nutritional Disease (Avitaminosis) in the Fowl New to Germany, by O. Seifried and J. Schaaf (pp. 357–374); Investigations of the Amylase Content of Milk of Different Animals, by R. Schenk (pp. 375–384); The Action of Quinine and Adrenaline on the Bovine Uterus, by H. Graf and H. Wander (pp. 385–397), with a list of 37 references to the literature; A Contribution on the Statics of the Pododerm (Hoof Skin) in Normal and Pathological Hoofs, by J. Bruhnke (pp. 398–425); A Contribution to the Knowledge of Tuberculosis of the Reproductive Organs of the Bovine and the Importance of Such Affections as Regards Danger of Infection and Sterility, by K. A. Hermansson (pp. 429–484), including a bibliography of 36 titles; A Contribution on Streptococcic Mastitis, I, by O. Pröscholdt (pp. 485–502); The Determination of Gestation by the Alcohol Extract Reaction of Lüttge and v. Mertz, and the Hormone Method of Dahmen-Wollersheim, by R. Helm and M. Zühdi (pp. 503–516), including a bibliography of 65 titles; The Lachrymal Canula, by K. Neumann-Kleinpaul (pp. 517, 518); The Action of Quinine and Acridine Derivative on *Bacillus abortus*, by J. L. Kritschewski and E. S. Heronimus (pp. 519–526); The Relation between the Blood Sugar and the Milk Sugar in the Milk of Cattle, by O. Scheicher (pp. 527–537); The Senile Changes of the Brain of the Horse, by K. Kikuchi (pp. 541–573); A Radiographic and Patho-histologic Study of Spavin in the Horse, I, by B. D. Hennichs (pp. 574–603); Some Affections of the Cornea of the Dog—I, Keratitis Superficialis Chronica Canis (Keratitis Pannosa and Pigmentosa Chronica) (pp. 604–610) and II, Macula Corneae Orbicularis, Disciformis (pp. 611–613), both by H. Veenendaal; Dung Disposal and Its Importance in Combating Foot-and-Mouth Disease, by K. Wagener (pp. 614–633), including a bibliography of 24 titles; A Mycotic Disease of the Frontal Sinus of the Horse Complicated by Meningitis, by N. A. Romanov (pp. 634–643); and The Mallophaga of Domestic Animals, I, by M. Zunker (pp. 644–660), including a bibliography of 26 titles.

[Contributions on animal pathology] (*Arch. Wiss. u. Prakt. Tierheilk., 59 (1929), Nos. 1, pp. 1–102, figs. 19; 2, pp. 111–202, figs. 15; 3, pp. 207–311, figs. 15; 4, pp. 315–414, figs. 24; 5, pp. 419–506, figs. 34; 6, pp. 511–600, figs. 19*).—The contributions here presented are as follows: The Pathogenesis of Thrush, by W. Gärtner (pp. 1–15), including a bibliography of 24 titles; Blood Sugar Investigations of Sound and Diseased Animals, I, by R. Völker (pp. 16–47), with 110 references to the literature; A Radiographic and Patho-histologic Study of Spavin in the Horse, II (see above), by B. D. Hennichs (pp. 48–81); Removal

of Bronchial Mucus with Neumann's Nasal Catheter, by E. Postl (pp. 82–84); Some Affections of the Cornea of the Dog—III, Opacitates Corneae Striatae Profundae, by H. Veenendaal (pp. 85–88) (see above), including a bibliography of 24 titles; Individual Reactions of the Blood of Sheep, Goats, Swine, and Cattle, by W. Kayser (pp. 89–102); Observations of Guarnieri's Vaccine Bodies, Their Relation to the So-called Fowl Pox Bodies and Others, by Inoculation of the Cornea of the Rabbit, by E. Eberbeck (pp. 111–131), including a bibliography of 27 titles; Investigations of the Etiology of Moon Blindness, I, by M. Berrár and R. Manninger (pp. 132–158); Some Affections of the Cornea of the Dog—IV, Keratitis Parenchymatosa of the Dog, by H. Veenendaal (pp. 159–191), including a bibliography of 38 titles; A Radiographic and Histo-pathologic Study of Spavin in the Horse, III, by B. D. Hennichs (pp. 192–202), with a bibliography of 33 titles; Periarteritis Nodosa in the Bovine, by A. Trawiński (pp. 207–210); *Boophilus annulatus calcaratus* Bir. as a Transmitter of Blood Parasites in the Caucasus, by W. L. Yakimoff and E. F. Rastegaïeff (pp. 211–222); The Reaction of the Feces of Horses, with Particular Reference to the H-ion Concentration, by B. Pötting (pp. 223–234); Experimental Rachitis in Rats, II, III, by O. Schultz (pp. 235–240, 241–247); The Dissemination and Combat of Bovine Piroplasmosis in Germany, by V. Goerttler (pp. 248–286), including a list of 192 references; Experiments with Valutin as an Anthelmintic for Horses, by H. Schlieter (pp. 287–300); The Distribution of Granulated Charcoal from the Abdominal Cavity, by H. Graf and R. Suhr (pp. 301–311); The Treatment of Some Febrile Conditions of the Horse with Selectan, by Neumann-Kleinpaul and Pessinger (pp. 315–349); The Liability in Undertaking Subcutaneous, Intravenous, and Intramuscular Injections, by J. Witte (pp. 350–383), including a bibliography of 287 titles; The Path of Medicaments Administered to Adult Cattle per Os with Liquids and Semiliquids, by P. Himmelreich (pp. 384–399); Experimental Rachitis in Rats, IV, V, by O. Schultz (pp. 400–407, 408–414); The *Bacillus gigas*, by J. Zeissler and L. Rassfeld (pp. 419–443); Bovine Piroplasmosis in Central Russia (U. S. S. R.), by W. L. Yakimoff and M. J. Scheinoff (pp. 444–450); A Contribution to the So-called Tumors, by W. Bolle (pp. 451–460), including a list of 131 references; A Case of Mediastinal Carcinoma in the Horse, by A. Algren and B. Stenström (pp. 461–466); Blood Sugar Investigations of Sound and Diseased Animals, II, by R. Völker (pp. 467–506), including 53 references; Further Contributions to the Investigation of Borna Disease of the Horse, by W. Zwick, O. Seifried, and J. Witte (pp. 511–545); The Court of Arbitration and Its Importance to the Stock Business, by Altenstein (pp. 546–564), including a list of 43 references; Concerning Dilaudid-Knoll, by J. Schmitt (pp. 565–572); Bacillary White Diarrhea of the Chick and Its Control—III, White Diarrhea in the Grown Fowl (E. S. R., 60, p. 671), by F. Schmidt-Hoensdorf (pp. 573–578); and Comparative Investigations of Physostigmine and Philocarpine Myosis in the Equine and Bovine, by H. Graf and E. Scheer (pp. 579–600).

Report of the chief, division of animal industry, for the year 1930, J. M. SINCLAIR (*South. Rhodesia Dept. Agr. Rpt. Sec. 1930, pp. 15–20*).—This report includes an account of the occurrence of and work with the infectious diseases of cattle.

Resistance to infectious diseases, H. ZINSSER (*New York: Macmillan Co., 1931, 4. ed., rev. and reset, pp. XVIII+[1]+651, figs. 32*).—This is a completely revised and reset edition of the work previously noted (E. S. R., 50, p. 581).

Serologic study of sixteen strains of Bacillus hemolyticus, L. R. VAWTER and E. RECORDS (*Jour. Infect. Diseases, 48 (1931), No. 6, pp. 581–587*).—At the Nevada Experiment Station 15 of the 16 strains of *B. hemolyticus* studied were

found to belong to the same agglutination group. One strain, the only variant encountered, agglutinated its homologous antigen slowly. Antigens prepared from this strain were not agglutinated by any of the serums prepared from the 15 other strains. Cross-agglutination did not occur when *B. hemolyticus* serums were titrated against antigens prepared from *B. chauvoei*, *B. welchii*, *Vibrion septique* (types I, II, and III), and 3 strains of *B. sordellii*. Furthermore, agglutinating serums specific for the other pathogenic anaerobes did not agglutinate *B. hemolyticus*. No definite conclusion was drawn as to *B. novyi*, owing to the instability of the antigens prepared from it. However, the failure of *B. novyi* serum to protect animals inoculated with *B. hemolyticus* confirms the antigenic difference between them. Agglutinins for *B. hemolyticus* were found specific for this species.

Rhipicephalus sanguineus and the virus of boutonneuse fever in Tunis [trans. title], P. Durand (*Compt. Rend. Acad. Sci.* [*Paris*], *192* (*1931*), *No. 14*, *pp. 857–859*).—This further contribution (E. S. R., 64, p. 756) presents experimental evidence that in Tunis as in France the brown dog tick may be a carrier of the virus of fièvre boutonneuse (exanthematous fever) and conserve it for many weeks at least.

The virus of boutonneuse fever is hereditary in Rhipicephalus sanguineus [trans. title], G. Blanc and J. Caminopetros (*Compt. Rend. Acad. Sci.* [*Paris*], *192* (*1931*), *No. 25*, *pp. 1682–1684*).—The authors have found that the virus of the exanthematous fever of Marseille is transmitted through the eggs of the brown dog tick, the emerging larvae being infective. This fact is considered to explain the persistence of the virus in certain lesions and its localization. See also a previous note (E. S. R., 65, p. 553).

Complement-fixation and agglutination tests in Brucella abortus infection, K. T. Sasano, D. Caldwell, and E. M. Medlar (*Jour. Infect. Diseases*, *48* (*1931*), *No. 6*, *pp. 576–580*).—The authors report that "the examination of serums from 1,000 persons revealed a positive complement fixation for *B. abortus* in 96 and a positive agglutination in 78. In only 5 cases was the diagnosis of undulant fever made. In each of these 5 cases complement fixation was positive, and agglutination was present in titers of from 1:135 to 1:1,200 at some time during the illness. Experiments on rabbits show that the complement-fixing substances and the agglutinins develop at about the same time, and that the complement-fixing substances persist longer than the agglutinins. Complement fixation and agglutination may be obtained for from months to years after apparent recovery from the infection. Because of this the diagnosis of undulant fever should not be made on the basis of a positive complement fixation or on that of serums producing an agglutination in dilutions of 1:15 or 1:45 in the absence of a positive blood culture."

Investigations of immunity to malignant edema [trans. title], I. M. Welikanow and E. N. Tolstuchina (*Zentbl. Bakt.* [*etc.*], *1. Abt.*, *Orig.*, *120* (*1931*), *No. 1–2*, *pp. 78–83*; *abs. in Vet. Bul.*, *1* (*1931*), *No. 2*, *p. 115*).—The authors have found that a fairly potent serum can be obtained from horses immunized with formolized vaccine of *Vibrion septique*. The virulence of this *V. septique* was attenuated by cultivation in media containing formol, pure cultures containing 0.5 to 0.7 per cent of formol having been found to be suitable for use as a vaccine and to possess good antigenic properties. This serum possessed therapeutic properties provided it was injected not less than 16 hours after infection.

An inapparent exanthematous fever provoked in man by Rhipicephalus sanguineus: Its virulence in the monkey and guinea pig [trans. title], J. Troisier and R. Cattan (*Compt. Rend. Acad. Sci.* [*Paris*], *193* (*1931*), *No. 1*, *pp. 91–92*).—Inoculation experiments in which an aqueous suspension of ground

brown dog ticks was used resulted in an inapparent infection in man, the blood having produced the disease in the monkey and guinea pig into which it was injected.

Hibernation of the virus of exanthematous fever of the Mediterranean region [trans. title], C. Joyeux and J. Pieri (*Compt. Rend. Acad. Sci. [Paris], 192 (1931), No. 11, pp. 705–707*).—The studies reported have shown that the brown dog tick may harbor the virus of exanthematous fever of the Mediterraneon region during at least the early part of the winter (to February 9). A report of studies of the transmission of the disease by this tick, by Brumpt, has been noted (E. S. R., 64, p. 756).

A yeast pathogenic for man and animals (Saccharomycete pleomorphus virulens), J. C. Norris (*South. Med. Jour., 24 (1931), No. 6, pp. 482–490, figs. 16; abs. in Jour. Trop. Med. and Hyg. [London], 34 (1931), No. 14, p. 217*).—The name *S. pleomorphus virulens* is proposed for a yeastlike organism which appears to be most consistently pathogenic and virulent, particularly for the guinea pig and rabbit. For over two years the culture has never failed to produce disease experimentally. It produces, both clinically and pathogenically, several types of lesions—the septicemic, the localized granulomata, the chronic (with lung, gland, and liver involvement), and the meningitic.

The use of organic iodine in the control of Bangs disease, J. W. Bartlett (*New Jersey Stas. Rpt. 1930, p. 105*).—In the course of 18 months' study of possible methods of curing cows known to be positive to the agglutination test for *Bacillus abortus*, in cooperation with the Browncone Laboratories, 25 milking cows received organic iodine in doses of from 10 to 20 cc. of a 5 per cent solution orally and 30 cc. of a 5 per cent solution of colloidal iodine in intravenous, intradermal, and intramuscular injections. Several of the animals appeared on monthly blood tests to give a very low agglutination and might be classed as only suspicious. One cow gave a negative report, and even though running with a positive herd remained negative throughout the experiment. There was but one abortion during the period of the experiment, and this case may have been due to causes other than *B. abortus*.

The results have led to the conclusion that generally in the case of animals that are positive to *B. abortus* cures can not be brought about. It is possible, however, that if the cows are treated in time, when the organism has only recently made its invasion into the blood system, the feeding of organic iodine may convert the infected animal to a negative condition.

An experimental study of "mad itch," with especial reference to its relationship to pseudorabies, R. E. Shope (*Jour. Expt. Med., 54 (1931), No. 2, pp. 233–248*).—In his study of an outbreak of "mad itch" observed in a herd of dairy cattle in Johnson County, Iowa, a preliminary account of which has been noted (E. S. R., 64, p. 476), the author has found that the disease is not contagious under laboratory conditions, the filtrable virus being restricted in the animal body largely to the region of inoculation and the lung. It can be stored for relatively long periods in 50 per cent glycerol or in the dried state.

A comparison of "mad itch" with pseudorabies has led to the tentative conclusion that the inciting agents of both are the same, although the strains of the two viruses studied by the author were found to possess readily demonstrable differences.

The treatment of the diarrheas of calves by bacteriophage [trans. title], J. Verge and M. Vallée (*Compt. Rend. Acad. Sci. [Paris], 192 (1931), No. 7, pp. 454–456; also in Rev. Gén. Méd. Vét., 40 (1931), No. 473, pp. 277–280*).—The authors have found a specific bacteriophage in the intestines of convalescent

subjects and increased its virulence until it has a high therapeutic value in the treatment of diarrhea or colibacillosis of young animals in general and of calves in particular. This bacteriophage is of no value in the treatment of diarrheas due to tuberculosis, paratuberculosis, paratyphoid, coccidiosis, etc.

Experimental infection of sheep with Dicrocoelium dendriticum, T. W. M. CAMERON (*Jour. Helminthol.*, *9* (*1931*), *No. 1*, *pp. 41–44*).—This is a preliminary note which will be followed by a detailed account of the life history and bionomics of this fluke.

Brucelliasis in the swine herd of the University of California, J. A. HOWARTH and F. M. HAYES (*Jour. Amer. Vet. Med. Assoc.*, *78* (*1931*), *No. 6*, *pp. 830–848*, *figs. 3*).—This is a report of the findings in observations made since the publications of Hayes (E. S. R., 46, p. 884) on the brucelliasis of swine in the University of California herd, where it has existed in an enzootic form for many years.

It was found that "incomplete isolation of swine reacting as positive and suspicious to the agglutination test was not of much value, since each consecutive blood test showed new reacting animals. The blood titer of reacting swine is variable and appears to recede at farrowing and rise again to its previous high level. A group of 43 pigs born of positive sows and confined in close quarters with positive animals reacted negatively for approximately 3 months after weaning, when 1 animal reacted positively, 1 suspiciously, and 5 animals reacted in 1:25 dilution only. Four sows advanced in pregnancy were inoculated intravenously with $\frac{1}{10}$ slant of *Brucella abortus* (*suis*), U. C. culture 55. These animals farrowed at full time; their blood titer remained uniformly high. The tissue cultures from 1 of these swine after being killed showed that the organisms were well distributed throughout the body. The breeding record of positive and negative sows from January, 1929, to August, 1930, shows an average percentage litter of 6.48 live pigs, and 2.64 dead pigs from the positive sows. The negative sows had a percentage litter of 6.54 live and 2.21 dead pigs. The time of gestation for the positive sows (31 farrowing) was normal, with the exception of 5 sows which aborted, 1 at 42 days, 1 at 73 days, 1 at 92 days, 1 at 81 days, and 1 at 109 days. The blood titer of young swine at birth, before they obtained colostrum, was negative. Blood tests taken on young swine after they had colostrous milk from positive sows reacted positively to the agglutination test, but again reacted negatively after weaning. A negative Holstein cow reacted positively to the agglutination test after 91 days close contact with positively reacting sows and their offspring."

Natural Brucella infection in swine, H. W. JOHNSON and I. F. HUDDLESON (*Jour. Amer. Vet. Med. Assoc.*, *78* (*1931*), *No. 6*, *pp. 849–862*).—The findings in studies conducted at the Michigan Experiment Station, here presented, are summarized as follows:

"Brucella infection in swine appears to be due to one species of Brucella, namely, *B. suis* (Traum). The rapid agglutination test is an accurate method of following the course of Brucella infection in swine. Brucella infection in swine appears to be a self-limiting disease, the majority of animals recovering at most within 5 months from the time agglutinins first appear in their blood. Infected sows or gilts do not conceive as readily as those that are not infected. The infection appears to be confined chiefly to the lymphatic tissues. The capacity of *B. suis* to invade the gravid uterus of sows or gilts does not appear to be marked. The field survey indicates that the disease is very prevalent in hogs in the State of Michigan."

B. hemolyticus infection in a hog, E. RECORDS and M. HUBER (*Jour. Amer. Vet. Med. Assoc.*, *78* (*1931*), *No. 6*, *pp. 863–865*).—In this contribution from the

Nevada Experiment Station, the authors report upon the finding of *Bacillus hemolyticus* to have caused the death of a hog, showing for the first time that this animal may be susceptible to natural infection with this organism.

Critical tests of miscellaneous drugs as anthelmintics for ascarids, whipworms, and nodular worms of swine, W. H. WRIGHT, J. BOZICEVICH, and F. C. UNDERWOOD (*North Amer. Vet., 12 (1931), No. 6, pp. 27–35*).—The details of tests made of hexyresorcinol, tung oil without a purgative, 2-chlorpentane, tetrachlorethylene in hard gelatin capsules, and N-butyl chloride as anthelmintics are reported in tabular form.

Hexylresorcinol showed a fair degree of efficacy for the removal of ascarids from swine, but is inferior to oil of chenopodium for this purpose. Hexylresorcinol is of some value for the removal of whipworms, but in single doses does not possess a sufficiently high degree of efficacy against these parasites to warrant the use of this expensive drug. The present tests indicate that hexylresorcinol is rather more effective in the treatment of swine for nodular worms than are the other drugs which have been tested in this connection. Tung oil from *Aleurites fordii* showed too little anthelmintic action against ascarids, whipworms, and nodular worms to warrant further test in this connection. Tests with 2-chlorpentane indicate that this compound is not effective for the removal of ascarids, whipworms, or nodular worms from swine. The efficacy of tetrachlorethylene for the removal of ascarids varied in 8 pigs from 2.4 to 75 per cent; the drug was not effective for the removal of nodular worms. Apparently tetrachlorethylene in the doses and manner used is decidedly inferior to oil of chenopodium for the removal of ascarids from swine. N-butyl chloride removed 75 per cent and 14.3 per cent, respectively, of the ascarids from 2 pigs, but showed practically no efficacy against nodular worms. The compound is not promising for use as an anthelmintic for the treatment of swine.

Report of the poultry pathologist, F. R. BEAUDETTE (*New Jersey Stas. Rpt. 1930, pp. 277–292, fig. 1*).—The first part of this report (pp. 277–284) deals with the pathological diagnosis of specimens received from 803 farms, all but 37 of which were located within the State.

In reporting further (E. S. R., 62, p. 670) upon epidemiological studies of fowl cholera, reference is made to an outbreak of the disease in Burlington County in which ducks, turkeys, and geese in addition to chickens were affected, the fluorescent type of the organism being found in each case. This is said to be the first outbreak of the disease in the State due to the fluorescent type that has come to attention.

An attempt made during the outbreak of fowl plague in Morris County to transmit the disease by mosquitoes resulted negatively. A method of immunization described by Todd (E. S. R., 60, p. 180) was used also with negative results. Two birds that recovered from the plague were used in immunity tests, one of which withstood an inoculation of 9,600 fatal doses of plague virus given intravenously. Later this bird received a large dose of plague virus intravenously, four hours after which it was bled from the heart and various doses of the blood were injected into healthy fowl subcutaneously. In no case did the inoculated fowl contract plague. At a later date titration studies showed that the blood serum of the immune fowl contained more than enough virucidal substance to neutralize the quantity of virus inoculated in the previous experiment.

An outbreak of a septicemic disease that occurred in Gloucester County was found to have been caused by a streptococcus of the hemolytic type and was pathogenic for fowls when introduced into the nasal cavity. "When given

per os in a capsule, it is without effect. Occasionally a fowl may become infected by drinking water contaminated with the organism, but in this instance the infection is undoubtedly brought about by contamination of the upper respiratory tract. Fowls that have resisted infection by per os inoculation are generally found to be susceptible to intranasal inoculation. Different degrees of susceptibility are shown when the organism is introduced intranasally. In most cases, the inoculated fowl dies of an acute septicemic infection. In other cases, the organism may localize in the eye, middle ear, or sinus and produce a condition not unlike that seen in localized fowl cholera infections. Similarly, some fowl resist intranasal infection, but, in most cases, these individuals become carriers of the organism."

What appeared to be a specific disease of the proventriculus and ventriculus was found in the spring in several lots of young chicks. In some preliminary experiments it was found possible to transmit this disease to other chicks by the feeding of infectious material.

In preliminary experiments with infectious bronchitis (E. S. R., 64, p. 178), it was found possible to reproduce the disease in healthy chickens by the intranasal or intratracheal instillation of infectious material. In an attempt next made to find the cause, an active virus was obtained in filtrates of Mandler and Berkefeld V candles and Seitz disks. Experiments aimed at determining the viability of the virus under various conditions showed it to maintain its potency for a period of 47 days in the dry state. Suspensions of virus held at room temperature are without effect after a few days, and similarly a 50 per cent glycerin suspension of the virus deteriorates at room temperature so that it will not produce the disease after 8 days' holding. At 22° F., however, glycerin suspensions maintain their potency for 18 days. It was demonstrated that the serum of a recovered bird possesses neutralizing properties and is immune to subsequent infection with bronchitis virus. It was found that the disease may manifest itself in different ways, but regardless of the type an immunity to subsequent infection is developed if the bird recovers. The disease is most readily reproduced by instilling the virus into the upper respiratory tract (eye, nasal cavity, or trachea), while subcutaneous inoculations have been irregular, it occasionally being brought about in this way.

The diagnostic work at the South Jersey laboratory, in which 2,249 specimens originating on 906 farms were examined, is reported in detail in tabular form.

Some pathological conditions found in the caeca of fowls, A. D. Baker (*Poultry Sci., 10 (1931), No. 5, pp. 246–258, figs. 19*).—This contribution, in which the author reviews the literature and reports on nodular formations and their histology, is accompanied by a list of 22 references to the literature.

Studies in the pathology of avian coccidiosis, H. J. Stafseth (*Jour. Amer. Vet. Med. Assoc., 78 (1931), No. 6, pp. 793–816, figs. 12*).—The author finds that in young chicks coccidia most frequently infect the ceca and the lower part of the small intestines. An infection may result in a fatal hemorrhage, due to the development of an immense number of coccidia in the cecal mucous membrane, and causing such extensive destruction of tissues as to bring about hemorrhage through the denuded and disintegrated mucosa. In birds over eight weeks of age the ceca are very seldom visibly affected. Duodenal infection is most common, but the other parts of the small intestines may be involved at times.

In this study the author observed several species of coccidia, *Eimeria tenella* and *E. acervulina* having been quite definitely recognized. Leg weakness and paralysis occur more frequently in connection with duodenal than cecal coccidiosis. Coccidia morphologically indistinguishable from some of those found in

chickens were found in pigeons showing leg weakness. Coccidia were not found in the livers of infected chickens. No evidence was found that sparrows carry the Eimeria.

Species of coccidia in chickens and quail in California, D. P. Henry (*Calif. Univ. Pubs. Zool., 36 (1931), No. 9, pp. 157–170, pls. 2*).—In this contribution the author reports on (1) the occurrence of in California and characteristics of four species of Eimeria described by Tyzzer from chickens (E. S. R., 62, p. 266), namely, *E. maxima* Tyzzer, *E. acervulina* Tyzzer, *E. tenella* Railliet & Lucet, and *E. mitis* Tyzzer; (2) the isolation of two of these species, *E. acervulina* and *E. tenella*, from turkeys, and of these two species and *E. mitis* from quail; and (3) the failure to infect chickens with various coccidia from other hosts.

Experimental infection with fowl cholera through the air [trans. title], A. Trillat (*Compt. Rend. Acad. Sci. [Paris], 192 (1931), No. 24, pp. 1598–1600*).—The author's experiments show that under favorable conditions, such as often occur in poultry houses, fowl cholera may be transmitted through the air.

The transmission of fowl-pox by mosquitoes.—Preliminary report, R. Matheson, E. L. Brunett, and A. L. Brody (*Poultry Sci., 10 (1931), No. 5, pp. 211–223, figs. 11*).—In the experiments conducted 9 positive transmissions of fowl pox by *Aedes vexans* Meig. were obtained and are here recorded. "In 3 of these experiments the presence of Bollinger bodies were demonstrated in the enlarged cells of the lesions. In 6 experiments fowl pox was transmitted 2, 3, 9, 16, 17, and 27 days after the mosquitoes had fed on fowl pox comb lesions. In 2 experiments transmissions occurred 3 and 9 days after feeding mosquitoes on raisins contaminated with fowl pox virus. Fowl pox was produced by inoculating the comb with a suspension of crushed mosquitoes which had fed on raisins contaminated with fowl pox virus 27 days previous. The first lesion developed 11 days after inoculation. In 2 experiments the same mosquitoes were used, producing inoculations 2 and 27 days after their infective meal. Between the inoculating experiments the mosquitoes were fed entirely on moist raisins."

Reference is made to work previously noted, including that of Kliger, Muckenfuss, and Rivers (E. S. R., 61, p. 274) and of Blanc and Caminopetros (E. S. R., 63, p. 775).

The susceptibility of the chorio-allantoic membrane of chick embryos to infection with the fowl-pox virus, A. M. Woodruff and E. W. Goodpasture (*Amer. Jour. Path., 7 (1931), No. 3, pp. 209–222, pls. 3, fig. 1*).—The authors find that the "ectodermal and entodermal cells of the chorio-allantoic membrane of the chick, as well as embryonic chick skin, are susceptible to infection with the virus of fowl pox at an early stage in the development of the embryo. Whether or not this specific susceptibility is acquired as a result of cellular differentiation has not been determined. Four methods for the isolation of uncontaminated fowl pox virus are described. In two of these methods the virus is developed in tissue that has never been contaminated by extraneous microorganisms. Fowl pox infection in the trachea of the adult hen has been induced by means of inoculation with uncontaminated virus."

The relation between fowl-pox (epithelioma contagiosum and avian diphtheria, I. J. Kligler and M. Aschner (*Brit. Jour. Expt. Path., 12 (1931), No. 1, pp. 35–42, pls. 2*).—The studies here reported have led to the conclusion that "fowl pox or contagious epithelioma and avian diphtheria are two distinct disease entities which may occur simultaneously or independently. There is no cross immunity between these affections. Fowl pox virus may attack the

tongue or oral mucosa with the production of ulcerative membranes. The membrane in this case is adherent, causes bleeding on removal, is leathery in consistency and circumscribed. Microscopically it is characterized by extensive necrosis of the epithelial tissue, infiltration, and the presence of typical inclusion bodies. The diphtheritic membranes are irregular whitish or yellowish patches, cheesy in consistency, only slightly adherent. They do not contain fowl pox virus. Histologically they appear as superimposed layers on the epithelium, which is only slightly injured. There is infiltration but little if any necrosis of tissue, and no inclusion bodies are found. The type of lesions which we found due to avitaminosis is distinctly different. Macroscopically they have the appearance of whitish pustules scattered over the whole of the mucous surface of the pharynx. Microscopically the lesion is shown to be confined to the glands."

Recovery of fowl-pox virus from vaccines by cataphoresis, I. J. KLIGLER (*Brit. Jour. Expt. Path., 12 (1931), No. 1, pp. 42–45, fig. 1*).—The author reports that by means of cataphoresis it was possible to obtain sufficient concentration of virus from each of three vaccines used to give positive lesions in five days. Two were phenolized vaccines prepared in the manner described previously (E. S. R., 63, p. 775), and one was a dried commercial vaccine known as the De Blieck vaccine. The virus was always recovered at the anode, while the material taken at the cathode was negative.

Calcium and phosphorus metabolism in the chicken.—II, "Range paralysis," G. E. HALL and E. J. KING (*Poultry Sci., 10 (1931), No. 5, pp. 259–268, figs. 6*).—The authors conclude that "the deformity in 'range paralysis' is not due to abnormal composition or structure of the bone. From a histological and chemical examination the bones appear to be normal. The only abnormal findings are subluxation, bowing, and rotation, as indicated by X-ray examination."

Piroplasmosis in Egyptian fowls (Aegyptianella pullorum) [trans. title], M. CARPANO (*Min. Agr. Egitto, Serv. Tec. e Sci. Bol. 86 (1929), pp. [1]+12, pls. 3*).—Attention is called to the fact that in this original publication the name of the causative organism is given as *Aegyptianella pullorum* instead of *Egyptianella pullorum* as it appeared in the English translation previously noted (E. S. R., 62, p. 566).

The presence of Aegyptianella pullorum in fowls in Algeria [trans. title], A. DONATIEN and F. LESTOQUARD (*Bul. Soc. Path. Exot., 24 (1931), No. 5, pp. 371, 372*).—The author reports having found an intracellular parasite in Algerian fowls during the summer of 1930 which appeared to be identical with *A. pullorum* described by Carpano in 1928 (noted above). Further observations are said to be necessary in order to determine the importance of the infection with this parasite in that country.

Spirochetosis associated with infectious bronchitis, M. W. EMMEL (*Jour. Amer. Vet. Med. Assoc., 78 (1931), No. 5, pp. 710, 711*).—The author records the occurrence of spirochetes in large numbers in smears prepared from the exudate and scrapings of the tracheas of birds affected with infectious bronchitis in Alabama. It is concluded from inoculation experiments that this spirochete was merely a secondary invader and not a direct etiological agent.

Ascaridia numidae, a parasite of the guinea hen, Numida meleagris, in Louisiana, G. DIKMANS (*Jour. Parasitol., 17 (1931), No. 4, p. 230*).—The author reports having found *A. numidae* in the small intestine of two guinea hens at Jeanerette, La., this being the first record of the occurrence of this nematode in native birds in the United States.

Capillaria annulata in Hungarian partridges, C. M. Hamilton (*Jour. Amer. Vet. Med. Assoc., 78 (1931), No. 6, pp. 865, 866*).—In this contribution from the Western Washington Experiment Station, the author reports having found *C. annulata* to parasitize the Hungarian partridge and to be a rather common parasite of this fowl. When present in large numbers, it will cause enough damage to the tissue of the esophagus and crop to cause death in the infested bird.

AGRICULTURAL ENGINEERING

[Agricultural engineering investigations at the Nebraska Station] (*Nebraska Sta. Rpt.* [*1930*], *pp. 8–10*).—In poultry house ventilation and construction studies the data obtained indicate that insulation had a beneficial effect on winter egg production, and that closing up a house all night during the winter season had no detrimental effect. The use of a small stove to lower the humidity was of doubtful value, but the use of steam heat increased egg production during the three winter months.

The study of wind-driven electric plants showed that high investment cost, high rate of battery depreciation, and uncertainty of wind velocity and duration combined to make the unit cost high and to limit the output of current and its uses. Apparently the owner of this type of plant can not apply the rule that increased use lowers the cost of current per unit.

The study of the use of electric power on Nebraska farms indicated the utility on many farms of a 3-h. p. motor for hay hoisting, feed grinding, and the construction and operation of the pit silo. With electricity at 5 cts. per kilowatt-hour it was found that the power cost for grinding corn fodder with a 7.5-h. p. motor is 32 cts. per ton.

Water supply and utilization, D. M. Baker and H. Conkling (*New York: John Wiley & Sons; London: Chapman & Hall, 1930, pp. XX+495, pl. 1, figs. 155*).—This book presents an outline of hydrology from the viewpoint of the arid section of the United States, together with an outline of water law and its administration as it has developed in the arid States. It contains chapters on climatology, precipitation, disposition of precipitation, evaporation, transpiration, stream flow and run-off, water rights in surface streams, determination of available water supply, ground water hydrology, ground water in alluvial deposits, water rights in underground water, purposes for which water is utilized, conflict and correlation between uses of water, administration of streams, valuation of water rights, and quality of water, together with an introductory chapter.

Surface water supply of the United States, 1927, II, XII A, XII C (*U. S. Geol. Survey, Water-Supply Papers 642 (1931), pp. V+103, fig. 1; 652 (1931), pp. V+111, fig. 1; 654 (1931), pp. VI+142, fig. 1*).—Of the papers which here present the results of measurements of flow made on streams during the year ended September 30, 1927, No. 642, prepared in cooperation with the States of Virginia and North Carolina, covers the South Atlantic slope and eastern Gulf of Mexico basins; No. 652, prepared in cooperation with the States of Washington, Montana, and Idaho, the Pacific slope basins in Washington and the upper Columbia River Basin; and No. 654, prepared in cooperation with the States of Oregon and Washington, the Pacific slope basins in Oregon and the lower Columbia River Basin.

Surface water supply of the United States, 1928, I, IV, IX, XI (*U. S. Geol. Survey, Water-Supply Papers 661 (1931), pp. VII+285, fig. 1; 664 (1931), pp. V+119, fig. 1; 669 (1931), pp. IV+96, fig. 1; 671 (1931), pp. IX+304, fig. 1*).—Of the papers which here present the results of measurements of flow made on streams during the year ended September 30, 1928, No. 661, prepared in coopera-

tion with the States of Maine, New Hampshire, Vermont, Massachusetts, Connecticut, New York, New Jersey, Maryland, and Virginia, covers the North Atlantic slope drainage basins; No. 664, prepared in cooperation with the States of Wisconsin, Illinois, Ohio, New York, and Vermont, the St. Lawrence River Basin; No. 669, prepared in cooperation with the States of Colorado, Wyoming, Utah, California, and Arizona, the Colorado River Basin; and No. 671, prepared in cooperation with the States of California and Oregon, the Pacific slope basins in California.

Surface water supply of Pacific slope basins in California, 1927 (*U. S. Geol. Survey, Water-Supply Paper 651 (1931), pp. IX+299, fig. 1*).—This report, prepared in cooperation with the States of California and Oregon, presents the results of measurements of flow made on streams in the Pacific slope basins in California during the year ended September 30, 1927.

Surface water supply of Pacific slope basins in Washington and upper Columbia River Basin, 1928 (*U. S. Geol. Survey, Water-Supply Paper 672 (1931), pp. VI+138, fig. 1*).—This report, prepared in cooperation with the States of Washington, Montana, and Idaho, presents the results of measurements of flow made on streams in these basins during the year ended September 30, 1928.

A preliminary report on the artesian water supply of Memphis, Tennessee, F. G. Wells (*U. S. Geol. Survey, Water-Supply Paper 638–A (1931), pp. II+34, pls. 2, figs. 7*).—This report, prepared in cooperation with the Tennessee Division of Geology, presents a statement on the history of artesian water development in Memphis and gives data on geology, pumpage, chemical character of the water, and the like.

Water supplies and sewage disposal (*New Jersey Stas. Rpt. 1930, pp. 58, 59*).—The progress of investigations with sprinkling filters, activated sludge, high temperature digestion, tank depth, biochemical oxygen demand, odor production, and fat separation is briefly presented. Much of the data has been reported in greater detail in Bulletin 521 (E. S. R., 65, p. 781).

Flood irrigation, H. E. Murdock and H. L. Lantz (*Mont. Agr. Col. Ext. Circ. 17 (1931), pp. 7, figs. 6*).—Practical information is given.

A survey of irrigation practices in the rice industry of Calauan, Laguna, A. L. Teodoro and E. Bataclan (*Philippine Agr., 20 (1931), No. 2, pp. 93–100*).—The results of this survey indicate that there are actually two periods in which water is needed for rice irrigation in Calauan, Laguna. The first period, comprising the land preparation, requires a constant supply of water for soaking and for puddling the fields for a period varying from 38 to 50 days. The greatest amount of water is used when the fields are being puddled before they become set. The water is most needed during the period of intermittent irrigations. The total number of days of intermittent plant submergence varies from 55 to 65 days.

Bibliography of physical properties and bearing value of soils, compiled by M. Scherro (*Amer. Soc. Civ. Engin. Proc., 57 (1931), No. 6, pp. 871–921*).—A bibliography of 800 references is presented which deals with slides, slips, and subsidences; chemical and physical properties; granular materials; foundations; and retaining walls. It is a contribution from the Carnegie Library of Pittsburgh.

Agricultural machinery, J. B. Davidson (*New York: John Wiley & Sons; London: Chapman & Hall, 1931, pp. X+396, figs. 600*).—This is a comprehensive handbook dealing with the elements of machine design as they relate to agricultural machinery, as well as the development and design of actual machines. It is based largely on the author's long experience at the Iowa Experiment Station. Chapters are included on the relation of agricultural

agricultural progress; the function of machines and some mechanical principles; the elements of machines; materials used in the construction of agricultural machines; the design of agricultural machines; transmission of power; measurement of power; friction and lubrication; tillage; plows; plow operation and adjustment; harrows, rollers, and pulverizers; cultivators; seeding machines; corn and cotton planters; grain-harvesting machines; threshing machines; combined harvesting and threshing machines; corn-harvesting machines; mowers; machines for making and handling hay; special machines for growing and processing cotton; special machines for growing potatoes; machines for growing garden and truck crops; special machines for corn; feed-preparing machines; grain cleaning, grading, and separating machines; grain conveying and elevating machines; machines for distributing fertilizer; pumps; spraying and dusting machines; machines for the dairy; vehicles; life, use, and cost of agricultural machines; selection and management of agricultural machines; care and repair of agricultural machines; and the manufacture of agricultural machinery in the United States.

First report of the Agricultural Machinery Testing Committee, W. C. D. Dampier-Whetham et al. (*[Gt. Brit.] Min. Agr. and Fisheries, Agr. Mach. Testing Com. Rpt., 1 (1931), pp. [191], pls. 14*).—This is the first report of the general work of the committee appointed to conduct individual tests of agricultural machinery in England.

The plan of these tests, as organized by the committee and approved by the Minister of Agriculture and Fisheries, provides for the carrying out of tests at selected institutions under the supervision of the committee, and for the issue of official certificates under the seal of the minister and of more detailed reports by the committee. The object is to furnish accurate information regarding the utility, efficiency, reliability, and working costs of each machine or implement tested. Each machine or implement is tested individually, and the certificate and report relate to that one machine or implement. Provision is made in certain cases for tests of different duration, the object being to cover different seasonal conditions. It appears that tests are conducted on application from manufacturers.

The details of the testing scheme are given, together with information relating to the payment of fees and the like. Appendixes are included relating to regulations governing the testing of agricultural machinery, fees charged for testing, and certificates and reports issued to date. The certificates enumerated deal with internal-combustion engines, spraying machinery, dairy machinery, tractors, refrigeration machinery, and harvesting and threshing machinery.

Test with wood gas propelled tractor (*Jour. Dept. Agr. So. Aust., 34 (1931), No. 11, pp. 1144–1146, fig. 1*).—This test was conducted in South Australia. The data show that with wood at about $10 per ton and gasoline at about 49 cts. per gallon the fuel cost of the wood gas tractor was less than one-fourth of that of the gasoline tractor. There was no noticeable difference in oil consumption, but the wood gas engine appeared to be more worn.

Tests on gas grain treater for the control of smut, J. Kienholz and W. K. Smith (*Northwest Science, 4 (1930), No. 4, pp. 101, 102, 114*).—Tests conducted at the Washington Experiment Station on the gas grain treater for the control of smut are briefly reported. The essential parts of the machine are a gas generator, pump, and conducting pipe. The apparatus is set up and the treating pipe inserted in the grain. A measured quantity of paraformaldehyde is placed in the generator cup, and gas is generated by heating this cup from below. Pumping is begun as soon as the liquid is ignited, and a steady

In tests to determine the effect of this method of treatment on germination of wheat, it was found that the seeds in the central portion of a 120-lb. sack were injured severely when the grain was allowed to stand 24 hours or more after treatment. Toward the outside of the sack, however, the grain gave a percentage germination as high as the untreated seed and higher than the standard formaldehyde dip.

With reference to the effect on the amount of stinking smut in a crop grown from smutted seeds, it was found that although the treatment may be harmful to the grain the damage may not be extensive, and there is a low percentage of smut in the sample drawn from the center of the sack when left 4 days after treatment. It appears, however, that the gas treatment is decidedly inferior to the standard formaldehyde dip.

Fruit packing equipment, W. LE G. BRERETON (*N. S. Wales Dept. Agr., Farmers' Bul. 165 (1931), pp. 28, figs. 34*).—Practical information on the planning, construction, and use of fruit packing equipment for New South Wales conditions is presented, together with drawings of benches, trolleys, presses, and a homemade fruit-sizing machine.

Electric hotbeds, R. R. PARKS (*Missouri Sta. Bul. 304 (1931), pp. 16, figs. 10*).—The results of investigations on the use of electricity for heating hotbeds are given. It was found economical, ordinarily, to substitute electricity for manure in hotbeds when the cost of trucking and labor in handling the manure is considered. Operating costs on electric hotbeds were found to vary with the season, the crop grown, the insulation, and the method of handling. In general, from 100 to 250 kw. hours are sufficient to heat a 6 by 12 ft. hotbed for one season. Under Missouri conditions it was found that immersion heater cables will give essentially the same results as oven-type heaters and will cost considerably less. A 6 by 12 ft. hotbed frame can be electrified for about $5.

Poultry housing and poultry house equipment for Montana, H. E. CUSHMAN (*Mont. Agr. Col. Ext. Bul. 115 (1931), pp. 20, figs. 19*).—Practical information is given on the planning and construction of poultry houses and equipment to meet conditions in Montana.

Bracing farm buildings, G. W. TRAYER and M. C. BETTS (*U. S. Dept. Agr. Leaflet 77 (1931), pp. 6, figs. 7*).—This is a contribution from the U. S. D. A. Forest Products Laboratory and the Bureau of Agricultural Engineering. It gives practical information on the bracing of farm buildings.

Sewage disposal for North Dakota farm homes, C. L. HAMILTON (*N. Dak. Agr. Col. Ext. Circ. 103 (1931), pp. 28, figs. 19*).—Practical information is given.

I, Influence of diluting water on the biochemical oxygen demand. II, Digestion of sludge from strawboard waste, E. F. ELDRIDGE and W. L. MALLMAN (*Mich. Engin. Expt. Sta. Bul. 39 (1931), pp. 14, figs. 4*).—Part 1 reports a bacteriological and chemical study of diluting waters for biochemical oxygen demand. The results indicate that a synthetic water containing the mineral salts common to natural waters is superior to distilled, bicarbonate, carbonate, and phosphate waters. Both tap water and synthetic water gave much higher biochemical oxygen demand results and bacterial counts than the other waters mentioned. A marked lag phase both in biochemical oxygen demand and bacterial activity was found in distilled, carbonate, bicarbonate, and phosphate waters. The biochemical oxygen demand values paralleled the bacterial counts. The two limiting factors were the H-ion concentration and the mineral salt content.

In part 2, experiments are reported in which strawboard sludge was mixed with sewage sludge and the rate of digestion as indicated by gas production was studied. A 1:1 mixture of the two sludges gave the largest volume of

gas per unit weight of sludge with the exception of the sample containing sewage sludge alone. The volatile matter decrease was about the same in all mixtures. The rate of gas production was prolonged according to the proportion of straw sludge added. The 1:1 mixture was about optimum from the standpoint of rate of digestion.

Milk products waste treatment.—Report No. 3, E. F. ELDRIDGE (*Mich. Engin. Expt. Sta. Bul. 36 (1931), pp. 35, figs. 12*).—Further studies on the treatment of milk waste products are reported (E. S. R., 65, p. 384), including preaeration studies and the biological filtration of whey solutions.

The results in general showed that septic tanks and all other methods which involve anaerobic bacterial action can not be used successfully with milk products waste. Broad irrigation on land is a suitable means of disposal. Chemical precipitation using lime and copperas will remove a portion of the milk solids from the waste if properly controlled but is not recommended owing to cost. Activated sludge, if properly controlled, will remove about 65 per cent of the milk solids but is expensive and difficult of operation and is not recommended.

Biological filtration over gravel, crushed stone, or slag was found to provide an efficient, relatively economical, and simple method of milk wastes treatment. The filter must be at least 7 ft. deep and should be composed of stones with a graded size of from 1.5 to 3.5 in. The waste should be applied at a rate not to exceed 1,000,000 gal. per acre per 24-hour day. The filter should not be operated longer than from 10 to 12 hours daily. The strength of the waste applied should not exceed 1,600 parts per million, provided it be an ordinary milk waste. Wastes higher in carbohydrates, such as whey, can be much stronger. A solution of whey containing as high as 10 per cent of that by-product can be treated on the biological filter provided the filter has been previously built up with the bacterial flora or the whey contains some milk waste or sanitary sewage.

Suggestions are given on construction and operation and on the treatment of combined sewage and milk waste as practiced at Mason, Mich.

AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY

[Investigations in agricultural economics at the New Jersey Stations, 1929–30] A. G. WALLER (*New Jersey Stas. Rpt. 1930, pp. 11–16, 93–99*).—Tables based on farm management business surveys are included showing the average man hours of labor, total costs, and yields per acre of small vegetable crops in the north Jersey market garden area in 1929; the investment, receipts, and expenses by items, and farm and labor incomes on the 10 best and the 10 poorest farms in 1927; the costs by items, receipts, and labor returns and distribution for different truck crops in 1929 in the same area; the investment, receipts, and expenses by items, farm and labor incomes, and yields and receipts per acre for different vegetables on Monmouth County truck farms in 1928; and a summary, by years 1926, 1927, and 1928, of the acreages of fruit trees, investment, receipts, and expenses by items, and farm income for Burlington County fruit and vegetable farms. The cost of production data for 1929 for potatoes, sweet corn, market tomatoes, and strawberries on central Jersey farms from which data were gathered are also summarized.

A study of farm taxation showed that from between 6 and 7 per cent to from 20 to 25 per cent of the total assessment against farm property in different counties was for personal property, the average for the State being about 15 per cent.

A table is given showing the percentage distribution of sales to commission men, farmers' markets, and to other outlets and at the farms of 251 New Jersey fruit and vegetable producers grouped according to different distances from New York City.

The dairy and poultry produce marketing situations in New Jersey, as shown by studies made, are discussed.

[Additional papers presented at the twenty-first annual meeting of the American Farm Economic Association] (*Jour. Farm Econ., 13 (1931), No. 3, pp. 361–409, 426–446*).—Included are the following papers read at the meeting previously referred to (E. S. R., 65, p. 579): The Influence of the Truck upon the Marketing of Fruits and Vegetables, by E. P. Weaver (pp. 361–375); The Influence of the Truck in Marketing Corn Belt Livestock, by G. F. Henning (pp. 376–392); Changes in Transportation and Agriculture, by O. B. Jesness (pp. 393–400); The Significance of Transportation Rate Policies in the Marketing Problem, by M. R. Benedict (pp. 401–409); Elements of Success in Cooperative Selling, by J. Brandt (pp. 426–431); Elements of Success in Cooperative Purchasing, by H. E. Babcock (pp. 432–437); and Pertinent Problems in Cooperative Marketing of Cotton, by W. M. Garrard (pp. 438–446).

The outlook for land utilization in the United States, O. E. BAKER (*U. S. Dept. Agr., Ext. Serv. Circ. 168 (1931), pp. [3]+33, figs. 22*).—This mimeographed circular includes the material presented in a series of addresses at the State leaders' conference, Fifth National Farm Boys' and Girls' 4-H Club Camp, Washington, D. C., June 17–20, 1931. The land resources of the United States and rate of depletion, the prospects for agricultural production and for consumption of farm products, and the possibilities of agricultural production in foreign countries are discussed.

The midlands grazing industry, A. BRIDGES and A. JONES (*Oxford: Univ. Oxford, Agr. Econ. Research Inst., 1931, pp. 55, figs. 2*).—This study of the relative economic advantages of grazing young or old cattle is based on a survey commenced in the spring of 1928 of 87 farms in the Leicestershire-Northamptonshire area. Analysis is made of the variations in the gross margin, total expenses, and profits and losses in different age groups; the factors affecting the extent of the gross margin; and the fluctuations in fat cattle prices.

Agriculture in the Chicago region, E. A. DUDDY (*Chicago: Univ. Chicago Press, 1929, pp. X+158, figs. 66*).—This is a study of an area of some 7,817 square miles in Illinois, Wisconsin, and Indiana within a radius of approximately 60 miles from Chicago. It is based chiefly on a special tabulation of the U. S. Bureau of the Census on a township basis of data of the 1925 census of agriculture. The topography, soils, drainage, climate, and growing season of the region are described. Tables, maps, and charts are included showing by townships the use made of the land; acreage and production of different field crops, fruits, and vegetables; number of different kinds of livestock; amount of livestock products; number and size of farms; value of land, buildings, and machinery and equipment; mortgage indebtedness; tenure of farm operators; farm population; etc.

Some factors causing variations in crop production costs in Putnam County, J. F. DOWLER (*Ohio Sta. Bul. 481 (1931), pp. 40*).—Data were obtained by the cost route method during 1926–1928 from 23 farms typical of the small grain region of northwestern Ohio. The records from 14 farms covered the 3 years, those from 6 farms 2 years, and those from 3 farms 1 year. Seventeen records were from farms of less than 100 acres, 31 from farms of 100 to 200 acres, and 10 from farms of 200 to 300 acres, the average being 140 acres with 118 acres in rotation. Fifteen farms were primarily 1-man farms with from

1 to 8 months' labor other than that of the operator, 6 were 2-man farms with from 11 to 21 months of extra labor, 1 a 3-man farm with 3 months' extra labor, and 1 a 4-man farm with about 7 months' extra labor. The main sources of income of the farms were from hogs, 36 per cent; cattle (chiefly dairy products), 21; crops, 29 (wheat 11, sugar beets 8, barley and oats 5, corn 2, and hay 1); poultry, 10; sheep, 2; and other sources, 2 per cent.

The factors affecting costs in general are analyzed, and the effects of size of fields, teams, and implements, efficiency of man labor, power costs, hauling manure, overhead charges, yields, date of planting, and application of fertilizer are discussed. Further analysis is made of the factors particularly affecting the costs of corn, sugar beets, small grains, and hay of different kinds. A table is included showing the costs and returns from different crops and the average annual labor incomes of the 23 farms, the 5 farms with the highest, and the 5 farms with the lowest labor incomes. The soil conditions, type of farming, distribution and yields of crops, amount of livestock, sources of income, kinds and amounts of labor and power used, etc., on the farms studied, and the methods used in computing costs are described.

On fields of less than 6 acres, 5.98 hours per acre were required for plowing of corn, 2.02 hours for cultivating with 1-row cultivators, and 1.22 hours with 2-row cultivators, as compared with 4.65, 1.65, and 0.85 hours, respectively, on fields of 12 acres or more. Forty-five acres of corn required 18 days more labor with 2-horse equipment than with 3- and 4-horse equipment. On the group of farms with the highest labor income an average day's work was accomplished in 28 per cent less time, and 37 per cent more productive work per man was performed, than on the farms in the lowest income group. The average number of hours worked per year per horse on different farms varied from 391 to 1,339 hours, averaging 867 hours. The costs per hour varied from 8.3 to 19.2 cts., averaging 11.8 cts.

The use of tractors to the extent of 2 hours per acre saved 47 per cent of the man labor and 28 per cent of the horse work per acre in producing corn up to harvest. Labor and power costs on farms using horses only were $8.19 per acre of corn, as compared with $7.12 on farms using tractors for a portion of the work. The tractor farms averaged 3.2 bu. higher yields and 4 cts. per bushel less cost than the horse farms. The time and cost per load of spreading manure varied from 0.7 to 1.7 hours and from $1.12 to 43 cts. The average overhead charges per crop acre were $1.30 for the 5 farms (averaging 189 crop acres) with the highest labor income and $3.69 for the 5 farms (averaging 93 crop acres) with the lowest labor income.

High crop yields cost more per acre but less per unit of production, and it was found to be more profitable to produce 1,800 bu. of corn on 30 acres than on 45 acres. Wheat planted before the average planting date yielded 25 per cent more than that planted later, oats 13 per cent, barley 27 per cent, and corn 22 per cent. Husking corn from the stalk and cribbing cost $4.98 per acre with a 48-bu. yield, and was the cheapest method of harvesting other than hogging down, when the stover was not considered. Cutting corn with a binder and husking with a shredder was the quickest and best method and required 15 hours of man labor per acre, as compared with 29 hours when cut and husked by hand and hauled to the barn. With the present prices of machinery and labor, stover is more cheaply harvested by hand methods. Sugar beets were found to cost twice as much to produce as corn. They required more labor, and a yield of over 7 tons per acre was found necessary to cover costs.

The average returns per acre above costs for the three years for different crops were for corn $6.37, wheat $18.47, oats $3.82, barley $3.89, alfalfa $7.06,

and beets $8.70. Alfalfa was produced at a cost of $8.95 per ton, as compared with $9.22 for clover and $9 for timothy.

Cost and efficiency in commercial egg production in Oregon, H. D. Scudder, A. S. Burrier, A. G. Lunn, and F. L. Knowlton (*Oregon Sta. Bul. 287 (1931), pp. 79, figs. 17*).—This study was made to determine the cost of producing commercial eggs, the factors in the operation and organization influencing cost, and the adjustments that should increase efficiency and reduce cost. Enterprise records for the period November 1, 1925, to October 31, 1928, inclusive, were obtained from 229 different farmers in different sections of the State, 74 giving records for all 3 years, 62 for 2 years, and 93 for 1 year.

Tables and charts are presented and discussed showing the amount and distribution of capital invested; cost of production, including averages for the farms studied, variations between regions, on different farms, and on the same farm, cash and noncash costs, and gross and net returns; the major factors influencing costs and profits, including those affecting egg production—proportion of pullets, culling, disease, lighting, breeding, and feeding and housing; labor efficiency; size of flock; prices and the factors affecting prices; the feeding system; housing; and the cost of pullet production. The present organization of commercial egg farms is described, adjustments in the present organization are suggested, and the future of the enterprise is discussed. The methods used in obtaining, compiling, and analyzing the data are described, and a nomograph chart is included for use in finding costs of production of eggs with varying labor and feed costs.

The average investment per hen was $4.56, of which 33 per cent was in hens and young stock, 30 in laying houses, 14 in poultry land, 6 in brooder and range houses, 4 in poultry feed on hand, 3 in automobile and trucks, 4 in other machinery and equipment, 2 in fencing, and 4 per cent in other improvements. The average net annual cost for the 3 years was $4.09 per hen, or 28.7 cts. per dozen eggs, of which 65 per cent was cash cost, 54 per cent was for feed, and 19 per cent for labor. Cost per dozen eggs averaged 22.6 cts. for the best 20 per cent of the flocks, 24.9 cts. for the best 50 per cent, 37.4 cts. for the poorest 20 per cent, and 33 cts. for the poorest 50 per cent. The market value of all eggs averaged 29 cts. per dozen, the average for the 92 per cent sold as market eggs being 28.8 cts. Gross annual income per hen was $4.96, of which $4.14 was from eggs. Annual profits or losses, return for operator's labor, and return for labor and capital varied from a profit of $1.16 and returns of $1.92 and $2.14 per hen, respectively, for 19 per cent of the flocks to a loss of $1.34, a deficit of 12 cts., and a return of only 14 cts., respectively, for 18 per cent of the flocks. For 50 per cent of the flocks the profit per hen was 63 cts., return for operator's labor $1.43, and return for labor and capital $1.65. For the other 50 per cent there was a loss of 64 cts. and returns of only 41 cts. for operator's labor and 64 cts. for labor and capital.

The average number of eggs per hen per year was 171 for all flocks. The cost of production for the 38 per cent of the flocks averaging 196 eggs was 10 cts. per dozen lower than that for the 12 per cent averaging 128 eggs. A yield of 170 eggs per hen was required to pay all costs and a yield of 110 eggs to pay cash costs. Pullets increased yields, and a flock with 60 per cent pullets was found to be a safe and successful standard. Culling about 39 per cent each year appeared to be a successful standard rate. Disease losses per flock averaged 18 per cent, ranging as high as 30 per cent in 12 per cent of the flocks, but averaging only 7 per cent in nearly 50 per cent. Artificial lighting did not appear to be an important factor in either costs or profits.

The most efficient operators obtained 113 eggs per hour of labor and had a labor income of 59 cts. per hour, as compared with 23 eggs and 12 cts., respectively, for the least efficient operators. The former cared for 2,000 hens per year, the latter for 400 hens. Chore route was an outstanding factor in labor efficiency.

The flocks surveyed averaged 615 hens. The minimum economic unit on a diversified farm was found to be 400 hens with 600 a better unit. The minimum economic unit for a one-operator full-time poultry farm was found to be 1,200 to 1,500 hens.

Market associations, through superior grade and pack and selling organization, were able to obtain a premium for Oregon eggs. Hatching-egg production offered considerable price advantage. The feeding system, housing, and cost of pullet production also had considerable effect on costs.

The small specialized poultry farm was found to have rather rigid requirements for success, and the poultry farm diversified with other enterprises to provide a sure income.

The plight of cigarette tobacco, T. J. Woofter, jr. (*Chapel Hill: Univ. N. C. Press, 1931, pp. XI+99, figs. 15*).—This is one of the regional studies of social and economic conditions being made under the auspices of the Institute for Research in Social Science at the University of North Carolina. It describes the factors in tobacco culture, the positions of the farmer and manufacturer, and the auction-market system. Analysis is made of the relationships between the production, consumption, and price of flue-cured tobacco. The advantages and disadvantages of cooperative marketing in the tobacco industry are discussed.

Florida truck crop competition.—I, Inter-State and foreign, C. V. Noble and M. A. Brooker (*Florida Sta. Bul. 224 (1931), pp. 168, figs. 73*).—This study of the week-to-week competition between Florida growers and producers in other States and foreign countries is based on data covering the crop years 1924–25 to 1928–29, inclusive, from the Weekly Summary of Car-lot Shipments of the Bureau of Agricultural Economics, U. S. D. A. The data are presented in charts showing for string beans, cabbage, celery, cucumbers, eggplants, lettuce, green peas, peppers, early potatoes, strawberries, tomatoes, and watermelons for each crop year, by weeks, the car-lot shipments from Florida and the total competing shipments from other States and total imports. The economic importance of Florida truck crops and the competition in cantaloupes, cauliflower, and onions are briefly discussed.

An appendix includes tables showing for the several crops the car-lot shipments from Florida, from other States, and from other countries, by weeks, during the period of the study and also during the 1929–30 crop season.

Report of the royal commission investigating the fruit industry (and interrelated conditions) of the districts territorially known as the Okanagan, Kootenay, and Kettle River of the Province of British Columbia. Part II, W. S. Evans (*Victoria: Prov. Govt., 1931, pp. 29, figs. 2*).—This is part 2 of the report previously noted (E. S. R., 63, p. 887). It deals with the subjects of production and marketing.

Middlemen's margins, H. J. Stover (*Jour. Farm Econ., 13 (1931), No. 3, pp. 447–459), figs. 3*).—This is a discussion and criticism of the paper of H. I. Richards, previously noted (E. S. R., 65, p. 276).

Crops and Markets, [August, 1931] (*U. S. Dept. Agr., Crops and Markets, 8 (1931), No. 8, pp. 289–344, figs. 3*).—Included are tables, charts, notes, reports, and summaries of the usual types; the cotton report as of August 1, 1931; the lamb crop, 1931; the sheep and wool outlook, July, 1931; the poultry and egg outlook, July, 1931; the cold storage holdings report of August 1, 1931; and tables showing the sales of fertilizer in the cotton States, 1931; the use of

commercial fertilizer on cotton, by States, 1930 and 1931; the wool production, by States, 1930 and 1931; oleomargarine production, by months, January, 1930, to May, 1931; and the forced sales of farm real estate, by States, for the years ended March 15, 1930 and 1931.

The contribution of Nebraska farm women to family income through poultry and dairy products, M. R. CLARK (*Nebraska Sta. Bul. 258 (1931), pp. 32, figs. 5*).—Analysis is made of records for the period April 1, 1929, to March 31, 1930, kept by farm women in 9 different counties of the State, there being 159 for poultry and 154 for dairying. Tables, charts, and text show the size and tenure of farms; size of flocks and herds and the average value of flocks, herds, and equipment at the beginning and end of the period; the production, sales, and home consumption of products and the value of each, by months; the time spent, by months, by home makers and others in the care of poultry and dairy products; the average value of stock, feed, equipment, supplies, etc., purchased, by months; the total receipts, expenses, and gross, net, and labor incomes; and the number and percentage of the groups reporting various hourly incomes. The following table summarizes the financial and labor findings of the study:

Financial and labor results for poultry and dairying on Nebraska farms

	Poultry	Dairy
Initial inventory value	$183.37	$851.77.
Final inventory value	$189.64	$830.20.
Gross income	$330.55	$755.04.
Expense	$180.11	$355.78.
Net income	$156.71	$377.74.
Interest charge	$9.17	$42.58.
Labor income	$147.54	$335.16.
Hourly return	$0.44	$0.40.
Hours per month—home makers	19 hours, 24 minutes.	24 hours, 23 minutes.
Hours per month—all others	8 hours, 20 minutes.	44 hours, 49 minutes.

The percentages of the groups making different hourly incomes were for poultry 8.8 per cent a loss, 8.1 per cent from 1 to 9 cts., 20.2 per cent 10 to 29 cts., 21.4 per cent 30 to 49 cts., 30.2 per cent 50 to 99 cts., and 11.3 per cent $1 and over; and for dairying 7.8 per cent a loss, 6.5 per cent from 1 to 9 cts., 22.7 per cent 10 to 29 cts., 28.6 per cent 30 to 49 cts., 30.5 per cent 50 to 99 cts., and 3.9 per cent $1 and over.

Organizations affecting farm youth in Locust Township, Columbia County, W. V. DENNIS (*Pennsylvania Sta. Bul. 265 (1931), pp. 43, figs. 13*).—This report of a study made in cooperation with the U. S. D. A. Bureau of Agricultural Economics is based on data obtained by a house-to-house canvass in 1926 of all homes in the area and includes 115 farm owner, 11 farm tenant, 19 laborer, 36 skilled worker, and 45 miscellaneous families, of which 213 had children totaling 792. The farming, population, home conveniences, automobile ownership, ages of heads of families, and the sex distribution of children 13 years of age and under and of those 14 to 21 years of age working at home or away are briefly discussed.

Tables are included and discussed showing (1) the percentage of each class of family making different types of nonorganizational contacts; (2) the total nonorganizational contacts for each class of family made by parents accompanied by children, by children alone, and by parents alone; (3) the contacts made by men, women, and children in each group through different kinds of organizations and through visits, trading and banking trips, motion pictures,

and vacations; and (4) the number of books and papers and magazines read. The relations of property accumulation and income from sales of farm products of the farm families to social activities and contacts and the social contacts of farm children over 14 years of age at home are analyzed.

The study showed that the membership of the relatively few social organizations found was drawn mainly from the farm owners and the professional and retired groups, that there was a positive relation between property accumulation and social activity of farm owner families, that the organizations for and activities of the rural children were inadequate, that the school and church have excellent opportunities to lead in promoting community-wide social programs, and that the many picnics, which are attended by all classes and form a valuable socializing agency during the summer, present a challenge to leaders to develop abundant recreational possibilities for both old and young.

AGRICULTURAL AND HOME ECONOMICS EDUCATION

Connecticut Agricultural College—A history, W. STEMMONS (*Storrs: Conn. Agr. Col., 1931, pp. [13]+258, pls. 15, fig. 1*).—This is a history of the first 50 years of the college and includes chapters on the Storrs Agricultural Experiment Station and the Extension Service of the college. The research was done in collaboration with A. Schenker.

Proceedings of the forty-fourth annual convention of the Association of Land-Grant Colleges and Universities, edited by C. A. MCCUE (*Assoc. Land-Grant Cols. and Univs. Proc., 44 (1930), pp. 488, figs. 10*).—This is the customary report of this convention (E. S. R., 63, p. 484) held at Washington, D. C., November 17-19, 1930, and previously discussed (E. S. R., 64, pp. 1, 98, 101).

The following papers and addresses, together with discussions, are included: Presidential address—Contributions of the Land-Grant Colleges and Universities to Our Social and Economic Progress, by A. M. Soule (pp. 26-42); The White House Conference on Child Health and Protection, by R. L. Wilbur (pp. 42-44); The Recommendations of the National Advisory Committee on Education, by G. F. Zook (pp. 45-51); Memorial to Dr. Howard Edwards, by J. L. Hills (pp. 51, 52); Business Cycles, by L. W. Wallace (pp. 53-58); Comments on the Recommendations of the National Advisory Committee on Education, by G. W. Rightmire (pp. 58-66); Educational Broadcasting, by W. J. Cooper (pp. 66-72); Results of the Survey of Land-Grant Institutions, by A. J. Klein (pp. 72-79); Address by W. O. Thompson (pp. 79, 80); The Federal Farm Board, by A. Legge (pp. 81-87); The Farmer and the Agricultural Colleges, by S. H. Thompson (pp. 88-98); Address of the Secretary of Agriculture, A. M. Hyde (pp. 99-107); Economic Readjustments of American Agriculture, by H. R. Tolley (pp. 108-114); Researches to Aid Readjustments in Agriculture, by E. Englund (pp. 115-123); Legislation Needed to Bring About Readjustments in Agriculture, by V. Christgau (pp. 123-130); Farm Taxation—The Problem and the Method of Studying It, by M. S. Kendrick (pp. 130-137) and by G. W. Forester (pp. 138-143); The Relation of State Research and Extension Agencies to the Readjustment of Agriculture in the Evolving Economic Situation, by A. Boss (pp. 143-149) and by H. W. Mumford (pp. 149-155); Agricultural Extension as Affected by Recent Economic Trends, by C. W. Warburton (pp. 156-163); Standards of Living as a Basis for an Agricultural Extension Program, by M. J. Reese (pp. 163-171); Recent Changes in Farm Crops Teaching, by E. R. Henson (pp. 172-181); The Correlation and Coordination of Technical Agriculture and Fundamental Science, by Z. P. Metcalf (pp. 181-186); The Psychological Basis of Method in Teaching, by P. J. Kruse (pp. 187-193); The Development of a Program for Teaching General Botany, by H. C. Sampson (pp. 193-

205); The Retiring Day, by E. M. Freeman (pp. 206–212); The Policy and Functions of the *Journal of Agricultural Research* in Relation to the Experiment Station, by M. C. Merrill (pp. 213–222); The First Five Years of the Purnell Act, by W. H. Evans (pp. 224–231); The Numerous Demands for Travel to Conferences, Meetings, etc., and How to Deal with Them, by W. C. Coffey (pp. 231–235); The First Census of Distribution, with Especial Reference to Its Possible Contribution to State and National Agricultural Policies and Research, by C. D. Bohannan (pp. 239–252); Correlating Foreign Plant Introduction with Experiment Station Projects, by K. E. Ryerson (pp. 252–256); The Use of Electricity on Farms, by R. J. Baldwin (pp. 257–262); Use of Electricity on Farms, by P. V. Maris (pp. 262–264); Underlying Factors of Success or Failure in Farm Organizations, by T. A. Coleman (pp. 264–266); Enlarging the Content and Influence of Home Demonstrations, by M. Horton (pp. 266–270); Farm Organization for Extension Work, by C. E. Ladd (pp. 271–273); Reaching Farmers with Economic Information, by C. F. Monroe (pp. 273–280); The Next Steps in Club Work, by C. B. Smith (pp. 280–284); The Status of Instruction in Aeronautics in Colleges and in Private Flying Schools in the United States, by H. J. Dana (pp. 306–321); Agricultural Engineering Research and the Engineering Experiment Stations, by R. W. Trullinger (pp. 324–338); The Status of Engineering Experiment Station Legislation, by A. Marston (pp. 339–350); Placement of Engineering Graduates, by R. I. Rees (pp. 352–370); Adjusting the College Graduate in Industry, by C. S. Coler (pp. 370–380); Methods of Improving Our Teaching Procedure, by M. Justin (pp. 381, 382); Cost Studies—Comparing Home Economics with Other Fields, by F. Harrison (pp. 383–387); Effective Placement, Organization and Method of Teaching Family Relationships, by A. L. Marlatt (pp. 390–396); Home Economics and the White House Conference, by L. Stanley (pp. 396–400); The Part of Home Economics in the Adult Education Program, by A. H. Arlitt (pp. 400–403); Cooperation of Home Economics Divisions with Commercial Organizations in Research Work, by R. O'Brien (pp. 406, 407); The Relation of Research in Child Development to Parent Education, by F. M. Thurston (pp. 407–409); and Organization of a Program of Research, by S. L. Smith (pp. 413–421).

Reports of standing, special, joint, and special research committees, and of the officers are also included.

[Papers and committee reports presented at the eleventh convention of the Canadian Society of Technical Agriculturists] (*Sci. Agr., 11 (1931), No. 12, pp. 825–866*).—Included are the reports noted below, together with the presidential address of W. T. Macoun; report of the general secretary, H. L. Trueman; and the report of the committee on publications, by L. E. Kirk.

Committee reports for the eleventh annual convention of the Canadian Society of Technical Agriculturists (*Ottawa: Canad. Soc. Tech. Agr., 1931, pp. 26*).—Included are the reports of committees at the convention held at Guelph, Ont., June 22–26, 1931, as follows: Committee on progress, by W. V. Longley; on agricultural policies, by E. A. Howes; on educational policies, by L. S. Klinck; on research, by W. H. Brittain; and on economics and marketing, by J. L. Lattimer.

Individual assignment in home economics teaching (*Jour. Home Econ., 23 (1931), No. 9, pp. 837–846*).—Included are descriptions of experiments with the Dalton, Morrison, and contract plans of teaching as applied to home economics, as follows: The Dalton Plan in a Freshman Clothing Course, by A. B. Robinson (pp. 837–840), a description of the use of the plan at the University of Illinois High School; An Adaptation of the Morrison Plan to

Home Economics, by M. L. Skinner (pp. 840–842), a description of a pajama project in the Marion, Kans., High School; and The Contract Plan, by M. E. Forrest (pp. 842–846), a description of work on a dinner in the River Falls, Wis., High School.

FOODS—HUMAN NUTRITION

Nutrition and diet therapy, F. T. PROUDFIT (*New York: Macmillan Co., 1931, 5. ed., rev., pp. VIII+705, figs. 11*).—This is a revision of a textbook which in the previous four editions has been entitled Dietetics for Nurses (E. S. R., 58, p. 456). The change in title represents a corresponding change in the text in which greater emphasis is placed on normal nutrition. This has necessitated a rearrangement of subject matter and the introduction in each of the chapters on diet therapy of a brief discussion of the normal functioning of the organ in question.

Food allergy, A. H. ROWE (*Philadelphia: Lea & Febiger, 1931, pp. XI+17–442.*)—This monograph discusses "food allergy from the clinical, historical, experimental, diagnostic, and therapeutic viewpoints." Of particular interest is the detailed description, with illustrative case reports, menus, and recipes, of the elimination method developed by the author (E. S. R., 60, p. 597) for the diagnosis and treatment of food sensitization, particularly when skin reactions are negative. Other sections of special interest are the chapters on food allergy in infancy and childhood and on individual food allergies and their control. The final chapter contains a summary of the literature on food allergy, with an extensive bibliography.

Effect of overgrinding of flour upon the keeping quality of bread, L. P. KARACSONYI and C. H. BAILEY (*Cereal Chem., 8 (1931), No. 1, pp. 44–46*).—Excessive grinding of flour was found to have no effect upon the keeping quality of bread as determined by the viscosimetric method developed by Karacsonyi.[2]

Progress report of the committee on standardization of laboratory baking, C. H. BAILEY (*Cereal Chem., 8 (1931), No. 1, pp. 63–68*).—This annual report (E. S. R., 64, p. 281) consists almost entirely of a preliminary report by the research fellow of the American Association of Cereal Chemists, P. P. Merritt, on a study of the effect of different variables on the standard baking test.

The stability of leavening in self-rising flour, P. LOGUE and E. MCKIM (*Cereal Chem., 8 (1931), No. 1, pp. 24–29, figs. 5*).—To determine whether or not the leavening ingredients in self-rising flour retain their properties through the normal period elapsing between the production and consumption of the flour, four samples of flour of moisture content varying from 11.32 to 14.02 per cent were made into self-rising flours according to the usual formula of 100 parts by weight of flour, 1.5 of soda, 1.75 of phosphate, and 2 of salt. The samples were stored in tightly sealed cans and tested periodically for over a year for available soda, as determined by carbon dioxide involved, and for pH. Biscuits were prepared from the various samples of flour and tested for lightness and volume.

It was found that the flours containing less than 12.5 per cent moisture were relatively stable, while those of higher moisture content decomposed more quickly and formed biscuits of inferior volume and lightness unless the amount of acid leavening agent was increased. Although the available soda, as measured by carbon dioxide, decreased rapidly at first and then more

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[2] Cereal Chem., 6 (1929), No. 3, pp. 241–248.

slowly with increased time of storage, the lightness and volume of the biscuits produced did not decrease in like order, but in every case showed a tendency to improve at some portion of the storage period. The freshness of the samples of flour at the beginning of the test is thought to be responsible for the improvement of baking quality on aging, which more than offset the loss of leavening strength. The two flours of lowest moisture content showed only slight fluctuations in pH with increasing storage, while the pH of the other two samples increased.

The mechanism of the increased alkalinity accompanying the premature decomposition of the flours is discussed.

Differences in the cooking quality of potatoes due to storage temperatures, W. M. PEACOCK, R. C. WRIGHT, T. M. WHITEMAN, and E. FULLER (*Potato Assoc. Amer. Proc., 17 (1930), pp. 109–116*).—This contribution from the Bureaus of Plant Industry and of Home Economics, U. S. D. A., consists of a brief résumé of cooking tests conducted on Irish Cobbler, Green Mountain, and Jersey Red Skin potatoes grown at the Arlington Experimental Farm, the first two varieties in silt and sandy loam and the third in upland gravelly clay loam. The Irish Cobbler and Green Mountain potatoes were harvested after maturing naturally, but the Jersey Red Skin potatoes, which had been killed by frost, were matured in the ground. Carefully selected tubers of uniform size and shape were stored in bushel baskets in storage rooms with controlled humidity and temperatures of 32, 36, 40, 50, 60, and 70° F. After varying periods of storage, the different samples were tested for cooking quality when steamed, boiled, baked, French fried, and made into chips according to standard methods.

Regardless of variety or length of storage period, the potatoes stored at temperatures under 50° were not satisfactory on account of a sweet taste and yellow color when boiled or steamed and a dark scorched color when French fried or made into chips. The cooking quality was best with the potatoes stored at 60°, although there was very little difference between those stored at 60° and 70°. Holding the potatoes at 60° for 1 or 2 weeks after storage at the lower temperatures improved the quality somewhat.

The results in general confirm those of Sweetman (E. S. R., 64, p. 193) in indicating that storage of potatoes at low temperatures is undesirable on account of the development of sugar.

Conservation of iron in vegetables by methods of preparation and cooking, O. SHEETS, E. FRAZIER, and D. DICKINS (*Mississippi Sta. Bul. 291 (1931), pp. 16*).—This publication contains the complete report of a study noted previously from preliminary reports (E. S. R., 64, p. 691). The method of determining iron, based upon the Kennedy method, is described in detail, and tabulated data are reported on the iron content as thus determined of the leafy portion, stalks, and ribs of turnip tops, collards, and mustard greens and of turnip roots and on the losses of iron in turnip tops, mustard, collards, and field peas in different methods of cooking. In conclusion, recommendations are given for methods of cooking various vegetables to conserve minerals and obtain the best flavor.

A study of whipping and coagulation of eggs of varying quality, J. L. ST. JOHN and I. H. FLOR (*Poultry Sci., 10 (1931), No. 2, pp. 71–82, figs. 8*).—Studies of the beating quality of the thin and thick portions of the whites of eggs and of the whole whites of eggs of varying quality and at different temperatures are reported, with the general conclusion that eggs with thin or watery whites are more desirable for beating than those with thick whites.

When equal amounts of the thin and thick portions of the whites of the same eggs were beaten separately, the volume was greater and the texture finer of the thin than the thick portion. This was also true of whole egg white graded

as thin or thick. Beating the whites at room temperature gave better results from the standpoint of volume and texture than at lower or higher temperatures. Eggs which had been in storage or were a few days old in general gave a larger volume on beating than eggs only a few hours old. This was attributed to the partial breaking down of the thick part of the white, forming more of the thin portion.

The common practice of adding a little water to egg white before beating is considered sound, especially if the white is very firm. The addition of a small amount of yolk to the white was shown to have a detrimental effect upon its beating ability, and it is considered that any fat would have the same effect.

Good things from the oven (*Illinois Sta. Circ. 370 (1931), pp. 72, figs. 21*).—This circular is essentially a revision and rearrangement by G. B. Armstrong, A. M. Schreiber, and M. A. McKee of the subject matter appearing in Circulars 262 (E. S. R., 47, p. 696) and 267 (E. S. R., 49, p. 494).

The standard metabolism of Australian aboriginals, C. S. Hicks, R. F. Matters, and M. L. Mitchell (*Aust. Jour. Expt. Biol. and Med. Sci., 8 (1931), No. 1, pp. 69–82*).—In this interim report, data are given on the basal metabolism and standing and sitting height of about 40 Australian aboriginals of the Kokata tribe. The Benedict portable apparatus was used for the oxygen consumption and the Douglas bag and Haldane gas analysis apparatus for the respiratory quotient determinations.

The metabolism results were very low, averaging 11 per cent (with the customary 5 per cent correction) below the Aub-DuBois standards for women and 13 per cent below those for men. The measurements of standing and sitting height gave unusually high values, the Von Pirquet index being over 100 in 52 per cent and over 108 in 16 per cent of the subjects studied. "In view of these abnormal pelidisi measurements it is considered doubtful as to whether European standards for computing basal metabolism are applicable in these cases."

Studies on the nutritive value of milk.—I, The deficiencies of an exclusive milk diet and how to overcome them, W. E. Krauss (*Ohio Sta. Bul. 477 (1931), pp. 54, figs. 22*).—This is the complete report of an investigation which has been noted previously from progress reports (E. S. R., 64, p. 672) and from a series of journal articles (E. S. R., 65, p. 297). In conclusion, the author discusses the practical significance of the investigation from the standpoint of human and animal feeding. A list of 65 references to the literature is appended.

Effects of a fat-free diet on the structure of the kidney in rats, V. G. Borland and C. M. Jackson (*Arch. Path., 11 (1931), No. 5, pp. 687–708, figs. 5*).—This paper reports histological studies of the kidneys from rats suffering from the deficiency disease considered by Burr and Burr (E. S. R., 63, p. 595) to be induced by rigid exclusion of fat from the diet. In all 124 animals were used, including a series from the studies of Burr and Burr and others from more recent experiments by Burr and Jackson. The animals included three groups of test, two of cured, and five of control animals.

The microscopic lesions observed confirmed fully the opinion expressed by Burr and Burr and also by McAmis, Anderson, and Mendel (E. S. R., 62, p. 291) that diets sufficiently low in fat cause renal disorders. The most characteristic and striking changes are considered to be calcification in the cells of some of the renal tubules and necrotic areas in the renal medulla, which may or may not be accompanied by various forms of renal epithelial degeneration and fatty or lipoidal changes. Other changes noted as sometimes but not always occurring are the accumulation of large quantities of fatty or albuminous material

in the medulla and atypical (uncornified) hyperplasia in the renal pelvic epithelium. The renal disorder can usually be prevented or cured to a large extent by the addition to the diet of from 2 to 20 per cent of lard or of slight amounts of cod-liver oil. Various other types of fat appeared to be somewhat less beneficial to the kidney, although capable of curing or greatly improving the general condition of the body. There appeared to be no definite relation between the concentration of the dietary protein within the range used and the incidence or severity of the renal lesions.

Composition of bone, X–XII (*Jour. Biol. Chem., 91 (1931), Nos. 1, pp. 271–290, fig. 1, pp. 291–305, figs. 6; 2, pp. 723–730*).—In continuation of this series of studies, some of which have been noted previously (E. S. R., 62, p. 296), three papers are presented.

X. *Mechanism of healing in low phosphorus rickets*, B. Kramer, M. J. Shear, and J. Siegel.—Experiments are reported which demonstrate that the rise in the product of calcium and inorganic phosphorus in the blood serum precedes the resumption of calcification in the healing of low phosphorus rickets in rats. This was noted not only in the healing induced by cod-liver oil or viosterol, but also in that induced by fasting and by added phosphate. Of the various theories which have been advanced to account for calcification (E. S. R., 60, p. 310), the precipitation theory is thought to offer the best explanation at the present time for these findings.

XI. *Binding of calcium ions by serum*, M. J. Shear and M. M. Offner.—Evidence is presented by means of conductivity titrations that some of the calcium in blood serum exists in an unionized form, the calcium ions apparently having formed calcium-protein complexes with the serum.

XII. *Effect of inadequate amounts of viosterol on the healing of rickets*, B. Kramer, M. J. Shear, and J. Siegel.—This consists chiefly of a criticism of the conclusions of Hess et al. (E. S. R., 64, p. 398) that rickets may be associated with normal concentrations of phosphorus in the blood.

In the experiments reported, which included curative tests with varying amounts of viosterol and with dried milk incorporated in the basal ration, the results were all consistent with the previous findings that whenever the Ca $\times$ P product in the blood serum rises above 40 calcification is resumed within a few hours. When the amounts of viosterol added were inadequate to cure rickets, the Ca $\times$ P products in no case rose above the rachitic level. The groups receiving amounts of dry milk equivalent to 10 cc. of milk daily showed considerable healing, and the Ca $\times$ P products ranged from 48 to 51. Attention is called to the fact that the healing obtained with dry milk was not typical, but took place irregularly and sporadically within the metaphysis instead of as a line of calcification at the provisional zone.

Synthetic rations and hemoglobin building.—A note on the Drabkin-Waggoner modification of the Biazzo method for determining copper, C. A. Elvehjem and E. B. Hart (*Jour. Biol. Chem., 91 (1931), No. 1, pp. 37–42*).—This is a reply to the paper of Drabkin and Waggoner (E. S. R., 65, p. 92), in which the Elvehjem-Lindow method of determining copper in biological materials (E. S. R., 61, p. 612) was criticized as inaccurate and a modified method was suggested. Figures are presented showing that the use of pyrophosphate, as suggested by Drabkin and Waggoner for preventing the interfering action of large amounts of ferric iron in the determination may lead to a serious loss of copper if the temperature and pH are not controlled. Analyses of the Drabkin "copper-free ration 1," or "low copper diet 1," by the pyrophosphate method under properly controlled conditions gave a copper content of from 0.022 to 0.025 mg. per 10 gm., a value approximately three times

as high as reported by Drabkin and Waggoner. Similarly, their "low copper diet 3," said to be extremely low in copper and still very active in promoting hemoglobin regeneration, was found to contain 0.017 mg. of copper per 10 gm. of ration. These amounts of copper are considered to be sufficiently high to account for the activity of these rations in hemoglobin regeneration.

The inability of metals other than copper to supplement iron in curing the nutritional anemia of rats, F. A. Underhill, J. M. Orten, and R. C. Lewis (*Jour. Biol. Chem., 91 (1931), No. 1, pp. 13–25, figs. 4*).—Further evidence confirming the theory first announced at the Wisconsin Experiment Station that iron alone is unable to regenerate hemoglobin in rats rendered anemic on whole milk and that copper is specific in its supplementing effect for iron is reported in a repetition of the procedure of Waddell, Steenbock, Elvehjem, and Hart (E. S. R., 59, p. 892) with the use of specially constructed glass cages for housing the rats and with every precaution to secure pure salts of the metals tested and to avoid contamination with iron or copper. With the technic employed, nutritional anemia was successfully produced in first generation rats and purified iron alone was ineffective in preventing or curing this anemia. Cobalt, nickel, zinc, and manganese given as supplements to iron were ineffective and copper effective in curing the anemia. Attention is called to slight temporary increases in hemoglobin in a number of rats given iron alone or with cobalt, nickel, zinc, or manganese. The suggestion is made that this may possibly have been due to previous storage of copper, but it is thought that more experimental evidence is necessary before this can be decided conclusively.

Carotene and vitamin A.—The conversion of carotene into vitamin A by fowl, N. S. Capper, I. M. W. McKibbin, and J. H. Prentice (*Biochem. Jour., 25 (1931), No. 1, pp. 265–274, figs. 5*).—This is the complete report, with experimental data, of an investigation noted previously from a preliminary report (E. S. R., 64, p. 588). In addition to demonstrating that the chick as well as the rat is capable of converting carotene into colorless vitamin A, the observations reported confirm earlier conclusions of Palmer and Kempster (E. S. R., 44, p. 70) that xanthophyll and not carotene is used by fowls for pigmentation of the beak and shanks, and also suggest the probability that the poultry disease visceral gout is related to vitamin A deficiency and curable by the administration either of carotene or cod-liver oil.

The vitamin A requirement of fowls proved to be very high. The minimum daily requirement of carotene for a hen weighing 2,000 gm. was estimated to be about 0.5 mg., in comparison with an estimated daily requirement of 0.002 mg. for a rat weighing 100 gm. The liver oils of fowls were shown to be very rich in vitamin A. The natural liver oil of one fowl procured in the open market was found in both color and feeding tests to be richer in vitamin A than the unsaponifiable fraction of cod-liver oil.

The authors note in conclusion that "the result of recent work on the relation of carotene to vitamin A makes it clear that biological tests alone can not distinguish between carotene and the 'classical' vitamin A, and it would seem probable that vitamin A is a product of animal synthesis and ultimately owes its origin entirely to carotene. Land animals can obtain carotene from vegetable matter, while Ahmad [E. S. R., 64, p. 587] has shown that carotene in diatoms is probably the source of the vitamin A of fish-liver oils."

The action of vitamin B [trans. title], Y. Teruuchi, T. Ohyama, and C. Wada (*Kitasato Arch. Expt. Med. [Tokyo], 8 (1931), No. 1, pp. 60–67*).—The authors claim to have isolated from polished rice a soluble toxin which, on subcutaneous injection in fowls, produces typical polyneuritis curable by vitamin B preparations administered intravenously or by mouth. On the basis

of these findings they conclude that polyneuritis is not a nutritional disturbance caused by lack of vitamin B, but rather an intoxication caused by a poison contained in the rice and that vitamin B acts in the sense of neutralizing this poison.

Calcification of the bones of rats on a diet low in ergosterol, E. M. Hume and H. H. Smith (*Biochem. Jour.*, 25 (*1931*), *No. 1, pp. 292–299*).—In an attempt to determine indirectly whether or not ergosterol can be synthesized in the animal body, comparable groups of rats were fed a diet as free as possible from ergosterol, one group with no addition and the other with an abundance of ergosterol. After about 80 days half of the rats in each group were irradiated with a quartz mercury vapor lamp daily for 40 days, when the rats were all killed and the dried fat-free bones analyzed for total ash.

The bones of all the rats showed a high percentage of ash, with practically no difference between the irradiated groups with or without ergosterol and the nonirradiated group receiving ergosterol. The ash of the group receiving neither irradiation nor ergosterol was significantly lower.

Although these results did not answer conclusively the question of the possibility of ergosterol synthesis in the rat body, they suggested a small supply of ergosterol from some source, either by synthesis or from a residual amount in the diet or the feces.

The relation of a fat-free diet to the scaly tail condition in rats described by Burr and Burr, E. M. Hume and H. H. Smith (*Biochem. Jour.*, 25 (*1931*), *No. 1, pp. 300–306*).—During the course of the investigation noted above, a scaly tail condition similar to that described by Burr and Burr (E. S. R., 62, p. 292) and attributed by them to lack of fat in the diet developed in all of the animals, not only those receiving the fat-free experimental diet but also those used for testing the materials employed as a source of vitamin B. These received 16 per cent of hardened cottonseed oil in the diet, together with from 3 to 5 drops of cod-liver oil daily. These observations are thought to indicate that absence of fat per se is not the cause of this condition.

A comparison of the results reported in the literature on the subject and the authors' own experience led to the hypothesis that "the etiology of the scaly tail syndrome lies in variation of the conditions governing the supply of the yeast vitamin complex."

To test this hypothesis, a comparison was made of the condition of rats receiving diets containing fat or no fat and kept on coarse or very fine wire screens, respectively. The commercial yeast extract marmite was used as the source of the B vitamins. With 15 per cent of marmite there was almost no development of the scaly condition whether the rats received fat or not. When the marmite was reduced to 8 per cent, symptoms developed approximately equally in groups with and without fat. The symptoms developed only slightly or not at all in the rats housed on fine screens, and became more marked when coarse screens were substituted. Autoclaved yeast was without beneficial effect, but dried yeast in a daily dose of 0.4 gm. caused improvement and, when begun early enough, complete cure.

These results, while not explaining the failure of fat to protect against the development of the scaly condition, are thought to rule out the hypothesis that the condition is the direct result of a fat deficiency. It is suggested tentatively that the addition of certain fats may operate by altering the consistency of the feces, rendering them more pasty and thereby promoting coprophagy.

The antiscorbutic potency of apples, II, M. F. Bracewell, F. Kidd, C. West, and S. S. Zilva (*Biochem. Jour.*, 25 (*1931*), *No. 1, pp. 138–143*).—In con-

tinuation of the investigation noted previously (E. S. R., 64, p. 497), data are reported on the antiscorbutic activity of further apple varieties, on the effect of low temperatures, maturity, and storage on the antiscorbutic activity, and on the distribution of vitamin C in various parts of the apple.

The new varieties tested were Newton Wonder and Lane Prince Albert. The former was found to have a vitamin C content of the order of Cox Orange Pippin, and the latter to occupy an intermediate position between these two varieties and the much more potent Bramley Seedling. Using Bramley Seedling in the other tests, it was found that this variety could be frozen at −20° C. (−4° F.) and stored at this temperature for 4 months without appreciable loss in antiscorbutic activity, that immature fruit was no more active per unit weight than the normal full grown and ripened fruit, and that storage in air at 3° did not bring about any destruction of vitamin C.

The content of vitamin C was found to decrease from the peel to the inner flesh, the former being more than six times as high as the latter. "It is impossible to say at this stage of the inquiry whether the disparity in activity between the different parts of the fruit has any physiological significance, but in view of the similar distribution of certain enzymes in the apple such a possibility must be borne in mind."

The antiscorbutic potency of apples, III, M. F. Bracewell, T. Wallace, and S. S. Zilva (*Biochem. Jour., 25 (1931), No. 1, pp. 144–146*).—In view of the fact that Bramley Seedling, with its very high vitamin C content, had a very low nitrogen content in comparison with the King Edward variety, samples of both varieties with high and low nitrogen content as the result of fertilizer treatment of the soil were examined for vitamin C content. It was found that King Edward apples containing about 0.0307 per cent of nitrogen were about 1.5 times as potent antiscorbutically as apples of the same variety containing about 0.0387 per cent of nitrogen, but that there were no significant differences in the vitamin C content of Bramley Seedling apples containing high and low quantities of nitrogen.

The mode of action of vitamin D.—Studies on hypervitaminosis D. The influence of the calcium-phosphate intake, L. J. Harris and J. R. M. Innes (*Biochem. Jour., 25 (1931), No. 1, pp. 367–390, pls. 2, figs. 15*).—In this paper the authors describe in considerable detail experiments on the influence of variations in calcium and phosphorus intake upon abnormalities resulting from overdoses of irradiated ergosterol, and discuss them especially in relation to the mode of action of the vitamin and with reference to the contributions of others along the same lines. Previous papers on various phases of the investigation, begun in 1928 and concluded in 1930, have been noted previously (E. S. R., 60, p. 196; 62, p. 197; 63, pp. 194, 295; 65, p. 95).

The observations reported, in conjunction with results described in the earlier papers, tend to reconcile some of the conflicting views reported in the literature, particularly concerning the source of excessive calcium and phosphorus in the blood stream in hypervitaminosis. Attention is called particularly to the fact that the extra calcium and phosphate may be derived in two ways: "(1) Increased net absorption from the gut and (2) increased withdrawal from bony stores, vitamin D, therefore, having a distributive action. In the hypervitaminosis produced on diets rich in calcium with moderate overdoses of vitamin D, the first of these factors is of special consequence, while with Ca-deficient diets and with larger excesses of the vitamin, withdrawal from the bone shaft is the main source. . . .

"Thus while addition of vitamin D to the diet tends to raise the blood-Ca (or -P, since one influences the other), the actual level so attained is the resultant of several factors. Operating in one direction is the increased net

absorption and dissolution from certain sites, and, in the opposite, the deposition in other sites, and (when high levels are reached) an increased urinary excretion. With increasing doses of vitamin D, the retention by the animal as a whole first rises but ultimately falls, the kidney excretion overtaking the gut absorption."

The effect of irradiation with ultra-violet light on the frequency of attacks of upper respiratory disease (common colds), J. A. Doull, M. Hardy, J. H. Clark, and N. B. Herman (*Amer. Jour. Hyg.*, *13* (*1931*), *No. 2*, *pp. 460–477*, *figs. 2*).—This study, which was carried on as a part of the program of the John J. Abel Fund for Research on the Common Cold, was instituted on account of the contradictory reports in the literature concerning the prophylactic value of ultra-violet light in acute upper respiratory disease, the common cold. See also other notes by Barenberg and Lewis (E. S. R., 58, p. 896); Maughan and Smiley (E. S. R., 61, p. 796); and Colebrook (E. S. R., 62, p. 593).

In the present study a group of 363 adult volunteers was kept under observation from September 29, 1929, to May 31, 1930, during which time an effort was made to secure reports of all cases of upper respiratory disease. Approximately one-half of the entire number were selected at random for irradiation during the first 31 weeks of the period. Mercury vapor lamps were used at moderate to light erythema dosage.

During the entire period of 35 weeks there were reported 930 attacks of common cold, of which 460 were among those receiving more than 10 irradiations, 19 among those receiving fewer than 10 irradiations, and 451 in the control group. When grouped according to previous susceptibility to cold, severity, and duration of attacks, no material difference could be observed in favor of the irradiated subjects. These findings thus appear to confirm those of Barenberg and Lewis and of Colebrook in showing no beneficial results of irradiation in the prophylaxis of the common cold.

A non-metal cage for small animals, A. H. Smith and R. O. Brooke (*Soc. Expt. Biol. and Med. Proc.*, *28* (*1931*), *No. 8*, *pp. 854–856*, *figs. 2*).—The essential parts of the cage described are a heat-resistant glass pie plate, "Save all pie plate, Glassbake 600," which has a shelf or flange half way up the beveled edge; a Pyrex cylinder 21 cm. inside diameter, 22 cm. outside diameter, and 16.5 cm. high; and two grids made of circular collars of galvanized iron 22.8 cm. in diameter and 5 cm. high, across which are bars 0.7 cm. apart, consisting of glass tubing 3 mm. outside diameter. These are held in place by No. 20 copper wire which runs through the tubing and through holes in the collar 1.5 cm. below the upper edge. The grids form the top and bottom of the cage or glass cylinder, which rests upon the flange in the pie plate. The food receptacle consists of a glass cup kept in place by a glass rod, the upper end of which passes through a cork held in a ring on the upper grid collar. A simple water fountain is also supported from the collar of the upper grid. Urine and feces are collected on a double layer of acid-soaked filter paper in the pie plate, the floor of which is 5.5 cm. below the upper surface of the grid which serves as the false bottom of the cage. It is stated that satisfactory recovery of nitrogen, calcium, and phosphorus has been obtained when the papers are changed every three days.

"This cage prevents access to metals, eliminates coprophagy, consists of easily replaceable parts with relatively low cost, and is readily cleaned and sterilized."

A cage, waterer, and feed cup for experimental rats, E. Douglass, J. W. Tobiska, and C. E. Vail (*Jour. Home Econ.*, *23* (*1931*), *No. 1*, *pp. 45–48*, *figs. 2*).—A brief description, with illustrations, is given of equipment for rat feeding

experiments which has been developed in the chemical laboratory at the Colorado Experiment Station. The cages are of two sizes, one for individual and one for stock rats. The cage for individual rats is constructed of 3-mesh hardware cloth or galvanized wire screening with tin pie plates for top and bottom. Glass castor cups are used as containers for the weighed food. The nonscattering food cup for the basal ration consists of an ordinary tin can in the top of which is fastened a muffin cup with a circular hole 1½ in. in diameter in the bottom. The waterer is an ordinary 4-oz. bottle with a bent glass delivering tube. The food cups are held in place by a bicycle trouser guard. The cost of the equipment for the individual cage is given as 71 cts., or about one-eighth as much as the regular price for such apparatus. The stock cage is built and equipped in the same manner, but is made larger. A shallow milk pan is used as the floor and the cover of a 50-lb. lard can for the top.

HOME MANAGEMENT AND EQUIPMENT

A study of washing machines, E. B. Snyder and M. P. Brunig (*Nebraska Sta. Research Bul. 56 (1931), pp. 44, figs. 10*).—A study of the performance and constructional features of four types of washing machines, including the dolly, gyrator, cylinder, and vacuum types, are reported. To study the cleansing action of different machines, they were used to wash test specimens of fabric which had been soiled under uniform conditions. The machines were operated under uniform conditions of time, temperature, and load, and amount and hardness of water and soap solution. The washed specimens were dried under uniform conditions and tested for whiteness or brightness by a photometric method. The brightness, which was the measure of cleanness of the washed specimens, was determined by comparison with a new, unwashed specimen of the same fabric, assumed to be 100 per cent clean.

The results showed that the maximum brightness of test specimens washed in the cylinder and vacuum machines was highest, slightly less from the gyrators, and lowest from the dolly machines. In general, specimens washed in the gyrator machines reached maximum brightness in less time than in other types.

Each machine appears to have an optimum washing period, which depends upon the character of the dirt used in soiling and is affected by the temperature of the water. Washing clothing longer than the optimum period apparently results in redistributing the dirt over the fabric. Medium temperatures (around 125° F.) gave the best results. Higher temperatures tended to cook or set the dirt into the meshes of the cloth.

There appears to be an optimum load for each machine. A decreased or increased load did not in general give as satisfactory results as did the optimum load.

To determine the comparative wear on fabric, strips of test material were washed under uniform conditions for the same length of time in the different machines. Samples, uniform in thread count, were cut from the test strips, conditioned as to moisture content, and tested for breaking strength by a Scott tester. The breaking strength of the washed samples was compared with the breaking strength of samples of the new, unwashed material of the same thread count conditioned in the same way. The results showed that the gyrator machines caused less wear than other types and the dolly machines the most. Differences in wear were of slight significance except for one dolly machine, which produced relatively great wear.

To determine the comparative heat retention of the different machines, they were filled with water at the same temperature and allowed to cool under

uniform conditions of room temperature and draft. The temperature of the water was taken at 10-minute intervals for a period of 1 hour. The machines were kept closed except to insert the thermometer. The results showed little difference in the cooling rate for the different machines. The machine having the highest cooling rate was the cylinder type, with large openings in both outside tub and inside cylinder.

"*No machines studied met all reasonable requirements in constructional features.*"

MISCELLANEOUS

Georgia Mountain Experiment Station, H. P. STUCKEY (*Georgia Sta. Circ. 92 (1931), pp. 8, figs. 5*).—The work of this substation, established near Blairsville in 1930, is briefly described.

Forty-fourth Annual Report of [Nebraska Station, 1930], [W. W. BURR] (*Nebraska Sta. Rpt. [1930], pp. 54*).—This contains the organization list, a report of the work of the station, and a financial statement for the fiscal year ended June 30, 1930. The experimental work reported and not previously noted is for the most part abstracted elsewhere in this issue.

Fifty-first Annual Report of the New Jersey State Agricultural Experiment Station and the Forty-third Annual Report of the New Jersey Agricultural College Experiment Station for the year ending June 30, 1930, J. G. LIPMAN ET AL. (*New Jersey Stas. Rpt. 1930, pp. XXIX+326, figs. 14*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1930, a report of the director on the work and publications of the year, with a summary of the first 50 years, and departmental reports, the experimental features of which not previously reported are for the most part abstracted elsewhere in this issue.

Forty-third Annual Report [of Tennessee Station], 1930, C. A. MOOERS ET AL. (*Tennessee Sta. Rpt. 1930, pp. 52*).—This contains the organization list, an account of the work of the station, and a financial statement as to the Federal funds for the fiscal year ended June 30, 1930. The experimental work reported and not previously noted is for the most part abstracted elsewhere in this issue.

Abstracts of Bulletins 405–420 and Circulars 55–58, A. D. JACKSON (*Texas Sta. Circ. 59 (1930), pp. 31*).—In addition to abstracts of the station's own publications as indicated, this circular contains abstracts of articles contributed by members of the staff for publication elsewhere. Some of these articles have been previously noted, and 11 others are abstracted elsewhere in this issue, the remainder being as follows: A New Loco from the Edwards Plateau of Texas, by V. L. Corey (p. 17); Modified Procedure with the Keitt Single-Spore Method, by W. N. Ezekiel (p. 19); On the Genus Viviania, with the Description of Two New Species from Texas (Tachinidae, Diptera), and A Synopsis of the Genus Macromeigenia, Including the Description of One New Species (Tachinidae, Diptera), both by H. J. Reinhard (p. 22); Reports of the Cotton Root-Rot Conference at Temple, Texas, by W. N. Ezekiel and D. C. Neal (p. 23); Two New North American Species of Muscoid Flies (Tachinidae, Diptera), by H. J. Reinhard (p. 23); Notes on Texas Bees, by H. B. Parks (p. 24); and A Study of the Insect Fauna of Brazos County, Texas, with Special Reference to the Cicadellidae, by R. K. Fletcher (p. 24).

NOTES

Arkansas University and Station.—Dr. Lewis M. Turner has been appointed assistant professor of forestry and assistant forester and is carrying on a marginal land study as a joint project between the departments of horticulture and forestry and rural economics and the Southern Forest Experiment Station. Dr. E. M. Cralley has been appointed assistant plant pathologist in the station for rice disease investigations, principally of stem rot. J. A. Dickey has been succeeded as assistant professor of rural economics and sociology and rural economist and sociologist by Dr. T. C. McCormick, who will make a study of the relationships of the rural social organizations to community organizations and community trade centers.

Iowa Station.—H. A. Derby, research assistant in dairying, has resigned to engage in commercial work.

Kentucky University and Station.—The new agricultural engineering building erected on the station farm at a cost of $75,000 is now in use. It is a two-story and basement structure, 198 by 98 ft. in size, with one-story wings which form a U-shaped inclosure for a machinery court in the rear. The basement is devoted to drainage, sanitation equipment, and concrete work laboratories, and storage rooms. The first floor is given over to laboratories for farm motors, tractors, machinery, buildings, shops, and experimental work, crop drying and storage rooms, and tool and recitation rooms. The second floor is available for offices, drafting and blue print rooms, and classrooms.

Maryland University and Station.—Among the new buildings under construction is a horticultural building to be completed about January 1, 1932. This will be a 3-story brick structure 80 ft. long by 50 ft. wide, with 2-story wings about 50 by 88 ft. It will be equipped to take care of various phases of the horticultural industry, including both instruction and experimentation.

The resignations are noted of Dr. C. M. Conrad, assistant professor of plant physiology and biochemistry and assistant plant physiologist, and Dr. C. L. Smith, instructor and assistant in plant physiology. Recent appointments include Dr. Roland Bamford in botany and plant anatomy and the following assistants: G. A. Greathouse and M. W. Parker in plant physiology, W. C. Supplee in chemistry on the palatability of meat project, L. P. Ditman in entomology, and Arthur B. Hamilton in agricultural economics.

Montana Station.—Frank T. Donaldson, assistant in chemistry, has resigned to take up graduate work, and has been succeeded by Cyril D. Evans, a 1931 graduate of the college.

Nevada Station.—Data collected since 1912 by the U. S. Bureau of Reclamation on the Newlands Reclamation Project in an annual crop and livestock census have been summarized and analyzed by the department of farm development to show the development of each enterprise on the project from 1912 to 1930 and the readjustments made by farmers in response to price changes. For 1930, it is concluded that nearly all of the readjustments made as a result of falling prices were contrary to the advice given in the outlook report issued by the extension service at the beginning of the year and adverse to the best interests of the farmers themselves.

INDEX OF NAMES

Aaron, H., 575.
Abbot, L. A., 478.
Abbott, F. H., 768.
Abbott, O. D., 488.
Abbott, W. L., 278.
Abel, F. A. E., 622, 815.
Abell, C. A., 423.
Aboulela, G., 224.
Abromavich, C. E., jr., 218.
Ackerson, C. W., 559, 862.
Ackert, J. E., 220.
Adams, G., 91.
Adams, J. F., 749.
Adams, M., 11.
Adams, W. L., 214, 553, 816.
Adamstone, F. B., 217.
Adler, S., 361.
Adriance, G. W., 232.
Aggery, 242.
Agnew, M. A., 190.
Ahmad, B., 612.
Aitken, H. A. A., 314.
Akemine, M., 628.
Alam, M., 817.
Albert, W. B., 630, 825.
Alberts, H. W., 732.
Albrecht, W. A., 33.
Alden, C. H., 458.
Alexander, A. S., 106.
Alexander, L. M., 393.
Alexander, L. T., 420.
Alexander, M. A., 300, 498, 762.
Algren, A., 870.
Allan, F. E., 221.
Allard, H. A., 623.
Allee, W. C., 845.
Allen, E. A., 545.
Allen, E. W., 101, 300, 701.
Allen, H. W., 59.
Allen, J. M., 400.
Allen, O. N., 422, 443, 813.
Allen, R. F., 444.
Allen, T., 87.
Allen, T. C., 453.
Allen, W., 80, 581, 680.
Allison, J. H., 233.
Allison, R. V., 414, 415.
Allwood, M. C., 641.
Allyn, W. P., 422.
Almon, L., 422.
Alp, H. H., 479, 765.
Alphandéry, E., 758.
Alquier, J., 97.
Alsberg, C. L., 202.
Altenstein, 870.
Alter, D., 509.
Alves da Silva, A., 655.
Alway, F. J., 633.
Ames, C. T., 126.
Amon, V. G., 557.
Anbô, H., 568.
Andersch, M., 695.
Anderson, A., 129, 346.
Anderson, A. C., 417.
Anderson, A. E., 580.
Anderson, A. P., 74.
Anderson, D. B., 118.
Anderson, E. G., 325, 521.
Anderson, H. W., 240, 750.
Anderson, M. S., 18.
Anderson, O. N., 79.
Anderson, P. J., 239, 334.
Anderson, W. B., 355.
Anderson, W. S., 254.
Andes, J. O., 149.
Andrewartha, H. G., 551, 657.
Andrews, F. M., 423.
Andrus, C. F., 445.
Ångström, A., 808.
Anissimoff, J., 80.
Anslow, G. A., 201.
Anthony, M. V., 458.
Anthony, R. D., 229.
Appleman, W. K., 10.
Arant, F. S., 449.
Arbuthnot, K. D., 453.
Arceneaux, G., 132, 531.
Archibald, J. G., 370, 767.
Arena, M., 26.
Arey, L. B., 122.
Arlitt, A. H., 889.
Armenag. Eff. Bedevian, 34.
Armentrout, C. B., 277.
Armington, J. H., 15.
Armitage, H. M., 156.
Armstrong, C., 571.
Armstrong, G. B., 892.
Armstrong, G. M., 630, 825.
Arndt, M. H., 65.
Arnim, B. von, 384.
Arnold, C. R., 579.
Asbury, C. E., 231.
Aschehoug, V., 292.
Aschner, M., 876.
Asdell, S. A., 254.
Ashbrook, F. G., 663.
Ashby, A. W., 79.
Ashby, R. C., 79.
Ashworth, J. T., 451.
Atkins, C. G., 530.
Atkinson, B., 662.
Attia, R., 358.
Atwater, W. O., 101, 701.
Atwood, H., 499.
Aubel, C. E., 698.
Aubert, P., 230.
Auhagen, E., 614.
Aull, G. H., 405, 406, 490.
Ausemus, E. R., 626.
Axtmayer, J. H., 397.
Aykroyd, W. R., 93.
Ayres, R. W., 743.
Ayres, W. E., 187.
Ayyar, T. S. R., 240.

Babcock, C. J., 259.
Babcock, E. B., 520, 786.
Babcock, H. E., 883.
Babcock, S. M., 300, 601, 602, 603, 799.
Babkina, S. A., 372.
Bachman, G. W., 73.
Back, E. A., 757.
Badertscher, A. E., 51.
Badger, L. F., 59, 657.
Baernstein, H. D., 206.
Baier, W., 568.
Bailey, C. F., 60.
Bailey, C. H., 890.
Bailey, E. M., 255, 789.
Bailey, E. Z., 227.
Bailey, J. S., 339.
Bailey, L. H., 227, 800.
Bailey, R. M., 200, 827.
Bailey, R. Y., 331.
Bailey, S. F., 754.
Bainer, R., 577, 578, 777.
Baird, W. W., 60.
Baker, A. D., 271, 875.
Baker, D. M., 878.
Baker, G. L., 407.
Baker, J. C., 799.
Baker, M. L., 660.
Baker, M. S., 729, 758.
Baker, O. E., 79, 580, 686, 883.
Baker, W. A., 453, 456.
Bakke, A., 292.
Bakken, H. H., 88.
Bakker, S., 70.

Balachowsky, A., 248.
Balbach, P., 38.
Balderston, R. W., 866.
Balduf, W. V., 655.
Baldwin, I. L., 442, 443, 471.
Baldwin, R. J., 889.
Ball, E. D., 798.
Ball, J., 27.
Ballantyne, S., 60.
Ballard, J. C., 808.
Balls, W. L., 84, 224.
Bally, W., 351, 649.
Bamford, R., 641, 900.
Bandemer, S. L., 412, 413.
Bane, L., 686.
Banfield, W. M., 43, 48, 440.
Barbee, C. L., 777.
Barker, H. D., 24.
Barnes, D., 201.
Barnes, H. F., 359.
Barnhart, G. S., 667.
Barnum, F., 698.
Barou, N., 389.
Barr, P. M., 836.
Barrett, J. T., 148.
Bartholomew, R. P., 212, 721.
Bartlett, A. W., 539.
Bartlett, J. M., 133, 137.
Bartlett, J. W., 498, 864, 872.
Barton, A. W., 423.
Barton, C. H., 675.
Basel, F., 868, 869.
Batacian, E., 879.
Bateman, G. Q., 679.
Bates, C. G., 643.
Bates, E. N., 281, 578.
Bates, G. H., 222.
Batjer, L. P., 739.
Bauer, F. C., 117, 323, 811.
Bauer, W. C., 273.
Baughman, W. F., 409, 410.
Baumann, C. A., 491.
Baumann, L. A., 259.
Baumann, R., 567.
Baver, L. D., 210, 415, 812.
Baxter, D. V., 150.
Baxter, T., 884.
Bayles, B. B., 338.
Beach, B. A., 470.
Beach, J. R., 674, 770, 771.
Beadle, G. W., 216.
Beal, W. H., 796.
Beale, R., 628.
Beals, E. A., 616.
Beamer, R. H., 654.
Bean, L. H., 79, 826.
Bear, F. E., 317, 826.
Beath, O. A., 160, 161, 177.
Beattie, H. G., 699.
Beattie, J. H., 225.
Beattie, W. R., 225.
Beaudette, F. R., 473, 674.
Beaumont, A. B., 302, 330, 337, 339.
Beaumont, J. H., 136, 137.
Beauverie, J., 119.
Beck, D. E., 50.
Beck, M. D., 570.
Beck, W., 802.
Becker, E. R., 353.
Becker, R. B., 254, 260, 467.
Beckwith, C. S., 342, 436, 834, 849.
Bedevian, Armenag Eff., 34.
Bedford, H. W., 246.
Bedson, S. P., 471.
Beicher, C. F., 352.
Bell, A. F., 441.
Bell, D. S., 661.
Bell, E. L., 655.
Bell, H. M., 277.
Bell, R. W., 409.
Beller, K., 869.
Belschner, H. G., 71, 571.
Bender, C. B., 498, 864.
Benedict, F. G., 98, 791, 857.
Benedict, M. R., 883.
Benjamin, H. R. 794.
Benlloch, M., 651.
Benner, J. W., 269.
Bennett, E., 337.
Bennett, H. H., 320.
Bennett, J. P., 150.
Bennett, J. S., 258.
Bennett, M. K., 82, 581, 681, 686.
Benson, A. O., 437.
Benton, T. H., 208.
Bercaw, L. O., 185, 484, 584, 786.
Beresford, H., 281.
Berg, G., 581.
Berkeley, G. H., 834.
Bernheim, K., 623.
Bernstein, F., 324.
Berrár, M., 870.
Berridge, A., 496.
Berthold, T., 336.
Bertholf, L. M., 362.
Beruldsen, E. T., 821.
Berwig, W., 852.
Besse, R. S., 740.
Bessey, G. E., 273.
Bethke, R. M., 257.
Betten, C., 499.
Betts, M. C., 881.
Bevan, L. A., 86.
Beynum, J. van, 867.
Bice, C. M., 368, 776.
Biekart, H. M., 835.
Biester, H. E., 572.
Bigger, J. H., 458.
Bills, C. E., 595.
Bindra, S. S., 655.
Binney, T. H., 67.
Bioletti, F. T., 736.
Birckner, V., 805.
Bird, J. J., 433, 633.
Birdseye, M., 192.
Birkinshaw, J. H., 566.
Bischoff, R. K., 724.
Bishop, S. C., 656.
Bisserup, A., 714.
Bissing, W. M. von, 583.
Bissonnette, T. H., 726.
Bitler, R. O., 38.
Bixby, F. L., 720.
Bizzell, J. A., 302.
Bjorka, K., 685.
Black, A. G., 80, 580.
Black, J. D., 79, 278, 388, 580.
Black, L. A., 565.
Black, L. M., 578.
Black, W. H., 254, 364.
Blackman, M. W., 551.
Blackshaw, J. F., 561.
Blagoveschenski, A. V., 310.
Blair, A. W., 621, 730, 810, 816.
Blair, G. W. S., 513.
Blair, T. A., 317, 807.
Blake, M. A., 41, 498, 831.
Blakeslee, A. F., 520.
Blanc, G., 553, 871.
Blanchard, R. A., 777.
Blanck, E., 714.
Blanck, F. C., 411.
Blandy, D. E., 576.
Blaney, J. E., 514.
Blank, L. M., 441.
Blasingame, R. U., 404, 405, 577.
Bleecker, W. L., 574.
Blieck, L. de, 473.
Blissett, A., 662.
Blizzard, W. L., 254, 553.
Blood, H. L., 441.
Bloom, M. A., 91.
Bloomfield, E. M., 290.
Blount, W. P., 267.
Blundell, L. L., 798.
Boak, R. A., 265, 773.
Bodman, G. B., 419.
Bodnar, G. P., 281, 578.
Boekhout, F. W. J., 867.
Bohannan, C. D., 889.
Bohstedt, G., 64, 254, 255, 459, 460, 462, 465, 466.
Bolle, W., 567, 870.
Bonacina, L. C. W., 809.
Bonde, R., 748, 749.
Bongert, J., 567.
Bonnen, C. A., 678.
Bonney, V. B., 190.
Booberg, G., 531.
Boone, R. C. P., 223.
Booth, J. F., 79.
Boothby, W. M., 395.
Bopst, L. E., 862.
Bordeleau, R., 60.
Borden, A. D., 752.
Borland, V. G., 892.
Borts, I. H., 671.
Bose, R. D., 424.
Boss, A., 80, 403, 888.
Bostian, C. H., 122, 158.
Botsford, R. C., 451, 657.

Bottens, S. P. de, 286.
Bottger, G. T., 456, 457.
Botts, A. K., 15.
Boucomont, A., 547.
Bourne, A. I., 343, 353, 355.
Bowling, G. A., 200.
Box, H. E., 359.
Boyce, E. F., 516, 553.
Boyd, O. C., 241, 343, 647.
Boyd, T. A., 274.
Boyden, R. E., 789.
Boyle, J. E., 683.
Boynton, W. H., 770.
Bozicevich, J., 874.
Bracewell, M. F., 895, 896.
Bracken, A. F., 627.
Brackett, E. E., 575.
Braden, R., 500.
Bradfield, R., 302.
Bradley, C. J., 185.
Bradley, J. C., 57.
Bradley, R. C., 498.
Braemer, P., 628.
Brandes, E. W., 580.
Brandon, J. F., 33, 35.
Brandt, J., 883.
Brandt, K., 80.
Brann, J. W., 441.
Brannon, J. M., 373.
Braun, C. E., 203.
Braun, E. W., 280.
Bray, C. I., 254, 497.
Brazie, D., 499.
Breaux, S. J., jr., 718.
Breed, R. S., 259, 866.
Bremer, G., 531.
Brennan, J. F., 317.
Brereton, W. le G., 881.
Bressman, E. N., 747.
Brewbaker, H. E., 824.
Brewer, C. M., 669.
Brewer, E. G., 457.
Briand, L. J., 655.
Bridges, A., 883.
Bridgford, R. O., 634.
Brierley, W. B., 522.
Brigden, (Mrs.) A. E., 286.
Briggs, F. N., 345.
Briggs, M., 798.
Brindley, T. A., 248.
Brink, R. A., 819.
Brinton, G., 285.
Brittain, W. H., 308, 889.
Britton, W. E., 451.
Broadfoot, W. C., 537.
Brocklesby, H. N., 595.
Brode, W. R., 806.
Brodell, A. P., 282.
Brody, A. L., 876.
Broerman, A., 73, 475.
Bromley, S. W., 50, 454.
Bronson, B. S., 392.
Brooke, R. O., 897.
Brooker, M. A., 886.
Brooks, C. F., 316.
Brooks, H. J., 798.
Brooks, J. E., 657.
Brooks, P. B., 865.
Brown, A. M., 538
Brown, C. A., 400.
Brown, G. A., 164, 255.
Brown, G. G., 534.
Brown, H. W., 568.
Brown, J. B., 663.
Brown, J. T., 385.
Brown, P. E., 17, 20, 21, 419, 619 ,620.
Brown, R. M., 509.
Brown, S. A., 277.
Browne, F. L., 76.
Bruce, E. A., 267.
Bruhnke, J., 567, 869.
Brumpt, E., 59, 553, 674.
Brunett, E. L., 876.
Brunig, M. P., 898.
Brunn, E. M., 683.
Brunner, E. deS., 686.
Brunner, W., 317.
Brunstetter, B. C., 508.
Buchanan, J. A., 478.
Buchanan, R. E., 106.
Buck, J. M., 265.
Buckell, E. R., 355.
Buckhannan, W. H., 117.
Buckner, G. D., 257, 367.
Buddin, W., 444.
Budge, W. K., 263.
Buisman, C., 352.
Bull, H., 742.
Bull, L. B., 570.
Bull, S., 367.
Buller, A. H. R., 442.
Bullis, D. E., 616, 787.
Bullis, K. L., 375.
Bunce, A. C., 642.
Bunker, J. W. M., 193.
Bünning, E., 723.
Bunyea, H., 271.
Burch, J. W., 253, 554, 555.
Burd, J. S., 318.
Burdette, R. C., 651, 849.
Burdick, R. T., 580.
Burger, I. J., 755.
Bürger, U., 868.
Burgess, A. F., 456.
Burgess, C., 385.
Burgess, P. S., 300.
Burk, E. F., 40.
Burke, A. D., 866.
Burke, E., 138.
Burke, R. T. A., 116.
Burmeister, C. A., 282.
Burnett, W. L., 650.
Burns, G. P., 436.
Burns, R. H., 254.
Burnside, C. E., 252.
Burr, W. W., 899.
Burrell, A. B., 854.
Burrier, A. S., 885.
Burrows, T. H., 303.
Busck, A., 655.
Bushnell, J., 433, 826.
Butcher, F. D., 56.
Butler, O., 578.
Butler, W. J., 546.
Button, F. C., 866.
Buxton, B. H., 519.
Byerly, T. C., 725.
Byers, H. G., 18, 19.

Caesar, L., 457.
Caine, A. B., 254.
Cairns, A., 79, 87.
Caldwell, D., 871.
Caldwell, G. C., 602.
Caldwell, M. L., 11.
Calhoun, J. C., 406.
Callander, W. F., 80.
Callenbach, E. W., 256.
Calvert, E. B., 509, 807.
Calvery, H. O., 524.
Cameron, D. C., 808.
Cameron, T. W. M., 873.
Cameron, W. P. L., 246.
Caminopetros, J., 553, 871.
Camp, A. F., 429, 434, 455.
Campbell, J. M., 274.
Campbell, K. W. D., 66, 371.
Campbell, P., 79.
Campbell, R. M., 79.
Campos Novaes, J. de, 351.
Canalizo, E. A., 683.
Cañizo, J. del, 651.
Cannon, C. Y., 65, 363.
Canon, H., 795.
Capper, N. S., 894.
Card, L. E., 256, 368.
Carimini, M., 546.
Carlin, J., 567.
Carlson, A. J., 30, 427.
Carlson, J. W., 432.
Carlyle, E. C., 841.
Carnes, A., 476.
Carnot, P., 772.
Carpano, M., 475, 877.
Carpenter, C. D., 675.
Carpenter, C. M., 265, 773.
Carpenter, D. C., 259.
Carpenter, E. J., 619.
Carpentieri, F., 640.
Carr, R. H., 254, 379.
Carr, W. H., 751.
Carrión, A. L., 361.
Carroll, J., 757.
Carroll, W. E., 253, 255, 367.
Carslaw, R. McG., 581.
Carter, C. W., 593, 596.
Carter, J., jr., 527.
Carter, R. H., 51.
Carter, W., 844, 853.
Cartland, G. F., 525.
Carver, G. W., 497.
Casanova, O. B., 126, 698.
Case, H. C. M., 276, 579.
Cash, J. R., 574.
Caskey, C., jr., 631.
Caspe, H., 794.
Caspe, S., 794.
Cassel, L. W., 499.
Castle, W. E., 525, 725.
Castro, G. M. de O., 250,

Cathcart, C. S., 23, 40, 857.
Cathcart, E. P., 290.
Catherwood, M. P., 284.
Cation, D., 519.
Cattan, R., 871.
Cave, C. J. P., 414, 809.
Cave, H. W., 698.
Cawood, M., 88.
Chabrolin, C., 346.
Chace, E. M., 509.
Chamberlin, J. C., 358, 845.
Chamberlin, N. S., 781.
Chamberlin, V. D., 560.
Chambers, S. W., 317.
Chamot, E M., 309.
Chan, K. S., 547.
Chandler, duP. (Mrs.), 600.
Chandler, W. H., 735.
Chandler, W. L., 175.
Chanutin, A., 492.
Chapman, P. J., 52, 851, 855.
Chapnick, M. H., 726.
Chaptal, L., 111.
Charles, J. H. V., 566.
Charles, T. B., 64.
Charles, V. K., 138.
Charmoy, D. d'E. de, 361.
Chase, H. W., 199.
Chatfield, C., 91.
Chen, H. T., 546.
Chen, T. T., 692.
Chenoweth, W. W., 394.
Chevalier, S., 617.
Chick, H., 502, 586, 591, 592.
Childs, L., 534.
Childs, W. H., 500.
Chinn, W. E., 359.
Chippindale, H. G., 840.
Christ, J. H., 222.
Christalon, A., 567.
Christenson, R. O., 178.
Christgau, V., 579, 888.
Christie, J. R., 361.
Christie, W., 327.
Christnach, W., 567.
Chung, H. L., 546.
Chupp, C., 842.
Church, A. E., 95.
Church, C. G., 509.
Church, J. E., jr., 599.
Churchill, B. R., 149, 628.
Claassen, P. W., 546.
Clague, J. A., 394.
Clair Potts, C. K. H., 628.
Clapp, A. L., 698.
Clarenburg, A., 472, 773.
Clark, A. W., 323.
Clark, C. D., 390, 891.
Clark, C. F., 827.
Clark, C. M., 480.
Clark, J. A., 60.
Clark, J. E., 414, 809.
Clark, J. H., 96, 831, 897.
Clark, M. R., 887.
Clark, N., 496.
Clark, N. A., 514.
Clark, P. F., 70.
Clark, S. P., 798.
Clarke, A. E., 325.
Clarke, G., 384.
Clarke, G. B., 276.
Clarke, G. R., 225.
Clarke, H. F., 530.
Clarke, H. T., 108.
Clarke, K. B., 807.
Clarke, S. H., 233.
Clarke, W. P., 498.
Claus, P. E., 219.
Clawson, A. B., 177.
Clayton, B. S., 575.
Clayton, E. E., 148, 699, 826.
Clemente, F. G., 651.
Clemson, T. G., 406.
Cleveland, C. R., 456.
Clevenger, W. L., 173.
Clifford, P. A., 190.
Clifford, W. M., 586.
Clutterbuck, P. W., 566.
Clutton, F. H., 683.
Clyde, A. W., 700.
Clyde, G. D., 616, 618.
Cock, S. A., 649.
Coe, M. R., 14.
Coen, B. F., 277, 687.
Coffey, W. C., 99, 889.
Coffman, F. A., 33, 35, 132.
Cohee, C. I., 866.
Cohen, R. L., 387.
Colby, B. C., 509.
Colby, B. R., 509.
Cole, H. H., 525.
Cole, W. C., 768.
Cole, W. E., 385.
Colegrove, K., 682.
Coleman, T. A., 889.
Coleman, W. B., 545.
Coler, C. S., 889.
Collins, C. W., 453.
Collins, E. V., 77.
Collins, G. N., 624.
Collins, J. L., 641.
Collision, R. C., 17.
Combs, W. B., 173.
Comish, N. H., 580.
Compere, H., 549, 552, 753.
Compton, R. T., 584.
Comstock, A. B., 105.
Comstock, J. H., 101, 103, 107.
Concepcion, I., 292.
Conklin, R. L., 672.
Conkling, H., 878.
Conn, H. J., 21.
Conner, S. D., 302.
Connors, C. H., 835.
Conrad, C. M., 900
Conrad, J. P., 31, 727.
Conway, H. M., 282.
Cook, M. T., 46, 150, 348, 349.
Cook, R., 383.
Cook, R. L., 496.
Cook, W., 246.
Cook, W. C., 244.
Cooley, J. L., jr., 31, 39, !
Cooley, L. M., 699.
Cooley, R. A., 546.
Coombes, W. K., 398.
Cooper, D., 541.
Cooper, H., 670.
Cooper, W. J., 888.
Cooper, W. S., 643.
Copeland, M. A., 479
Copping, A. M., 502, 59 592.
Corbett, G. H., 247, 756.
Corbett, R. B., 86.
Cordero, N., 292.
Cordley, A. B., 699.
Cordner, H. B., 227.
Cordy, C., 199.
Corey, E. L., 427.
Corl, C. F., 490.
Cornehl, B., 697.
Corneli, W., 501.
Cory, E. N., 59.
Cory, V. L., 817, 856, 89
Costanzo, G., 685.
Cottam, C., 545.
Cotterell, G. S., 246.
Cotton, W. E., 265.
Cottral, L. L., 808.
Coulson, E. J., 556.
Coulter, S. T., 173.
Courtney, O. K., 57.
Coville, S., 436.
Coward, K. H., 588.
Cowland, J. W., 246.
Cowles, M. L., 481.
Cowles, P. B., 264.
Cox, I. M., 866.
Coyne, F. P., 566.
Coyner, J. M., 461.
Crabb, E. D., 218.
Crafts, A. S., 533.
Craig, N., 36.
Craigie, J. H., 536.
Cralley, E. M., 900.
Cram, E. B., 181, 545.
Cramer, R, 419.
Crampton, E. W., 253.
Crane, H. L., 41, 835.
Crawford, B., 309.
Crawford, C. W., 255.
Crawford, D. L., 53.
Creech, G. T., 673.
Creighton, H. B., 818
Crim, R. F., 131.
Crist, J. W., 739.
Cross, F., 572.
Cross, H., 272.
Crouch, H. B., 853.
Crowther, C., 662.
Cruess, W. V., 214, 709, 71
Csonka, F. A., 10, 108.
Csontos, J., 573.
Culbertson, C. C., 63, 15 661.

Culbertson, J. O., 747.
Cunningham, H. G., jr., 700.
Cunningham, H. S., 699.
Cunningham, R. N., 644.
Curie, I. H., 813.
Curran, H. R., 378.
Currie, G. A., 56.
Curry, A. S., 535, 715.
Curtis, J. M., 30.
Curtiss, C. F., 105, 198.
Cushman, H. E., 881.
Cushman, R. A., 552.
Cutler, W. L., 339.

Dade, H. A., 535.
Dadisman, A. J., 189.
Dagger, G. N., 386.
Dahl, A. S., 44.
Dahl, C. G., 637.
Dahlberg, A. C., 259, 373, 866.
Dahle, C. D., 263, 667.
Dahmen, H., 567.
Daines, R. H., 200.
Dallas, G., 79.
D'Armour, F. E., 28, 30, 427.
Dampier-Whetham, W. C. D., 581, 880.
Dana, H. J., 889.
Danforth, C. H., 725.
Danforth, S. T., 243.
Daniel, D. M., 55.
Darbishire, F. V., 519.
Darling, R. C. M., 246.
Darlow, A. E., 254, 460, 554.
Darrow, G. M., 231.
Darrow, M. A., 21.
Dash, J. S., 526.
da Silva, A. Alves, 655.
Daugherty, M. M., 782.
Davenport, C. B., 725.
Davenport, E., 199.
Davey, N., 272.
David, J. T., 253.
Davidson, H. R., 63, 584, 662.
Davidson, J., 651.
Davidson, J. B., 77, 401, 879.
Davidson, O. W., 831.
Davidson, W. M., 51, 52.
Davies, E. S., 498.
Davis, A. C., 452, 754.
Davis, D. J., 70.
Davis, F. L., 100.
Davis, H., 290.
Davis, H. P., 262.
Davis, I. G., 79.
Davis, J. G., 93.
Davis, J. S., 580, 683.
Davis, L. D., 735, 736.
Davis, M. B., 25.
Davis, W. H., 343, 536.
Dawe, C. V., 80.
Dawes, H. W., 662.
Dawson, C. R., 467.
Dawson, J. R., 78.
Day, D., 216.
Day, L. H., 735.
Dayton, W. A., 623, 817.
D'Costa, J., 669.
Deacon, A., 799.
Dean, L. A., 620.
Deanesly, R., 30, 122.
Dearstyne, R. S., 168, 179, 180.
de Blieck, L., 473.
de Bottens, S. P., 286.
de Campos Novaes, J., 351.
de Charmoy, D. d'E., 361.
Deem, J. W., 533.
Deerr, N., 530.
Deeter, E. B., 116.
DeGant, F., 59
Delaplane, J. P., 499.
de Lavergne, A., 684.
del Cañizo, J., 651.
Delgado de Torres, D., 651.
del Guercio, G., 546.
DeLong, D. M., 54, 455.
Delos, A., 581.
Delwiche, E. J., 431.
Deming, G. W., 33, 34, 35.
Deming, J., 290.
d'Emmerez de Charmoy, D., 361.
Demourov, M., 555.
Dempsey, P. W., 340.
Demurov, M., 555.
Dencker, C. H. T., 405.
Denman, C. B., 253.
Dennis, W. V., 686, 887.
Denny, F. E., 24.
de Oliveira Castro, G. M., 250.
de Ong, E. R., 846.
de Póka-Pivny, A., 583.
Derby, H. A., 900.
Derick, R. A., 529.
DeRose, H. R., 23.
Derow, M. A., 193.
Derrick, B. B., 190.
Descazeaux, J., 378.
de Spéville, J. D., 531.
Detjen, L. R., 436.
de Torres, D. D., 651.
DeTurk, E. E., 117, 811.
Devereux, E. D., 262, 469.
de Vine, B., 662.
DeVries, T., 806.
de Vuyst, P., 287.
de Wachenfelt, M., 662.
Dexter, S. T., 422.
Dhar, N. R., 418.
d'Hauteserve, L., 483.
Dibble, L. S., 259.
Dicke, F. F., 457.
Dickey, J. A., 678, 900.
Dickins, D., 891.
Dickinson, C. G., 570.
Dickinson, L. J., 402.
Dickson, J. G., 307, 441.
Dickson, R. E., 332.
Dickson, W. F., 698.
Dietz, S. M., 49.
Dietze, C. von, 78.
Dijk, J. van, 531.
Dikmans, G., 877.
Dillman, A. C., 127.
Dillon Weston, W. A. R., 444.
Dinger, E. J., 550.
Diseker, E. G., 476.
Dithmar, H. R., 471.
Ditman, L. P., 900.
Dixon, H. M., 580.
Doak, K. D., 520.
Doan, C. A., 574.
Dobroscky, I. D., 357, 359.
Dodds, H. H., 530.
Dodge, B. O., 444.
Doisy, E. A., 30.
Domm, L. V., 27, 28, 218, 220, 381.
Donaldson, F. T., 900.
Donaldson, R. W., 330.
Donatien, A., 776, 877.
Donham, C. R., 72, 671, 672.
Doolittle, S. P., 237, 540.
Doran, W. L., 47, 343, 344.
D'Orchymont, A., 546.
Dorrance, A. B., 634.
Doten, S. B., 797.
Dougherty, J. E., 576.
Douglass, D., 698.
Douglass, E., 897.
Doull, J. A., 897.
Dove, W. F., 200.
Dowell, C. T., 497.
Dowler, J. F., 883.
Downes, W., 552.
Dowson, W. J., 542.
Doyle, L. P., 254, 259, 379
Dozier, H. D., 386.
Dozier, H. L., 50.
Drabkin, D. L., 92, 597.
Drain, B. D., 340, 799.
Draper, F., 798.
Drayton, F. L., 542.
Drechsler, C., 46, 539.
Dreesen, W. H., 79.
Driggers, B. F., 54, 55.
Drinkard, A. W., jr., 686.
Drury, A. N., 595.
Dubinin, N. P., 425.
Dublin, L. I., 686.
Duckham, A. N., 79, 584, 662.
Duddy, E. A., 883.
Duerst, J. U., 857.
Duffee, F. W., 466, 577.
Dufrenoy, J., 284, 536.
Duggar, B. M., 443.
Duggar, J. F., 428, 455.
Duke, M. M., 535.
Duncan, J. F., 79.
Duncan, J. R., 34.
Dunham, W. E., 855.
Dunihue, F. W., 352.

Dunkin, G. W., 270, 472, 572, 625.
Dunlap, G. L., 375.
Dunlavy, H., 320.
Dunn, L. C., 27, 425, 523.
Dunn, L. H., 250.
Dunn, M. S., 208.
Dunnewald, T. J., 300, 319.
du Plessis, A. F., 684.
Durand, P., 871.
Durant, A. J., 72.
Durst, C. E., 585.
Dustman, R. B., 629.
Dvorachek, H. E., 761.
Dyce, E. J., 856.
Dyer, F. J., 588.
Dyer, R. E., 59, 657.
Dykes, G. M., 79.
Dynes, O. W., 825.

Eagar, J. H., 627.
Earle, F. S., 530, 634.
Earp, J. R., 97.
Easterby, H. T., 531.
Eastham, A., 533.
Eaton, F. M., 208, 331.
Eaton, O. N., 26.
Eberbeck, E., 567, 870.
Eckerson, S. H., 829.
Eckles, C. H., 261, 267, 466.
Eckstein, K., 852.
Eddy, C. O., 155.
Eddy, W. H., 293.
Edgecombe, A. E., 746.
Edgerton, C. W., 828.
Edgington, B. H., 73.
Edgington, G., 18.
Edminster, L. R., 386.
Edmond, J. B., 698.
Edmonds, J. L., 255.
Edwards, E. E., 647.
Edwards, F. M., 160, 659.
Edwards, H., 888.
Edwards, J. T., 571.
Edwards, R. W., 74.
Effatoun, H. C., 57.
Eheart, J. F., 700, 739.
Eichler, E., 378.
Eigendorf, R., 567.
Eke, P. A., 580.
Ekman, G., 623.
Elcock, H. A., 36.
Elder, C., 176, 300.
Eldridge, E. F., 384, 881, 882.
Ellenberger, H. B., 469.
Ellenwood, C. W., 139.
Ellett, W. B., 739.
Elliott, A. G., 533.
Elliott, F. F., 580, 678.
Ellis, N. R., 555.
Ellison, E. S., 808.
Ellsworth, J. K., 752.
Elmer, O. H., 43, 542.
Elmhirst, L. K., 79.
Elmquist, R., 598.
Elsdon, G. D., 314.
Elvehjem, C. A., 893.
Elwell, J. A., 16.
Elze, D. L., 757.
Emerson, R. A., 521, 625, 819.
Emmel, M. W., 382, 475, 877.
Emmert, E. M., 312.
Enfield, R. R., 78.
Engberg, R. C., 580.
Engel, E. O., 852.
English, L. L., 450.
Englund, E., 388, 888.
Erdman, H. E., 580.
Erf, L. A., 660.
Ernst, Z., 313.
Errington, P. L., 449.
Eshbaugh, F. P., 341.
Essary, S. H., 350, 825, 830.
Essig, E. O., 753.
Esskuchen, E., 524.
Ettisch, G., 802, 803.
Ettrich, R., 568.
Evans, C. D., 900.
Evans, F. R., 665.
Evans, H. M., 613.
Evans, W. H., 701, 889.
Evans, W. S., 886.
Evaul, E. E., 31.
Evers, N., 314.
Evershed, W. A., 675.
Evvard, J. M., 63, 159, 661.
Ewing, D. T., 504.
Eyer, J. R., 853.
Eyre, F. H., 743.
Eyre, J. W. H., 69.
Eyster, W. H., 819.
Ezekiel, M., 78, 282.
Ezekiel, W. N., 841, 899.

Faber, J., 261.
Fabian, F. W., 470.
Fabricius, N. E., 68, 69.
Fackler, H. L., 150, 799.
Faes, H., 230.
Fahnestock, M. K., 297.
Fajardo, T. G., 747.
Falconer, J. I., 385, 481, 678.
Falcon-Lesses, M., 792.
Falkenstein, R. B., 757.
Faning, E. L., 625.
Fankhanel, W. R., 387.
Fankhauser, F., 642.
Fanning, J. W., 390.
Faragó, F., 803.
Fargo, J. M., 459, 461.
Faris, J. A., 46.
Farlinger, D. F., 458.
Farlow, M. A., 657.
Farnsworth, H. C., 681.
Farrar, C. L., 855.
Farrar, M. D., 855.
Farrington, C. C., 484.
Farrington, E. H., 799.
Farris, N. F., 31.
Fassig, O. L., 617.
Faust, E. C., 244.
Fawcett, E. J., 581, 584.
Fay, A. C., 698.
Federighi, H., 243.
Feldkamp, C. L., 400.
Feldman, W. H., 570.
Fellers, C. R., 315, 394.
Felt, E. P., 50, 454, 546.
Fenton, F. C., 404, 677.
Ferrari, J. J., 378.
Ferrin, E. F., 255.
Fevold, H. L., 219, 428.
Feytaud, J., 249.
Ficht, G. A., 456.
Ficklen, J. B., 504.
Fielding, J. G., 499.
Figurovsky, J. V., 414.
Filinger, G. A., 699, 798.
Filmer, R. S., 55.
Finch, A. H., 798.
Finn, W. G., 278.
Finnell, H. H., 129, 330, 734.
Firkins, B. J., 619.
Firor, W. M., 29, 427.
Fischer, E. K., 204.
Fish, P. A., 200.
Fish, S., 648, 649.
Fisher, C. D., 709.
Fisher, D. F., 454.
Fisher, H. J., 249.
Fisher, R. A., 425.
Fisher, R. C., 259.
Fisher, W. S., 657.
Fishwick, V. C., 662.
Fisk, V. C., 48.
Fiske, J. G., 39, 634.
Fitch, C. L., 826.
Fitch, C. P., 177.
Fitch, J. B., 663.
Fite, A. B., 534, 535.
Fitton, E. M., 316.
Fitzgerald, D. A., 684.
Flanders, S. E., 361, 856.
Fleming, C. E., 668, 761, 772.
Fleming, J. A., 316.
Fletcher, E. H., 808.
Fletcher, L. J., 405.
Fletcher, R. K., 899.
Fletcher, S. W., 301, 303.
Flint, O. S., 375.
Flint, W. P., 454, 845.
Flor, I. H., 891.
Florell, V. H., 326.
Fluke, C. L., 452, 453.
Fluke, C. L., jr., 458.
Foley, R. C., 254, 330.
Folsom, D., 749, 826, 827.
Fong, W. Y., 214.
Forbes, C. S., 657.
Ford, E. B., 520.
Forester, G. W., 888.
Forman, L., 847.
Forrest, M. E., 890.
Forrester, R. B., 684.
Forshaw, W. H., 662.
Forsling, C. L., 477.

Forster, H. C., 646.
Foster, J. E., 254.
Foster, K. L., 396.
Foster, M. L., 201.
Foster, R. G., 687.
Foster, W. A., 479.
Foster, W. I., 463.
Fowler, A. B., 71.
Fowler, E. D., 619.
Fowler, R., 654.
Fox, F. E., 662.
Fox, H., 57.
Fox, H. D., 859.
Fox, R. H., 100.
Foy, N. R., 533.
Frame, B. H., 385.
Francioni, J. B., jr., 498.
Francis, L. D., 794.
Francke, G., 566.
Frandsen, J. H., 372.
Frank, A. H., 254.
Frank, G., 604.
Franklin, H. J., 339, 356.
Franssen, C. J. H., 851.
Fraps, G. S., 216, 294, 506, 615, 813, 835.
Frawley, J. M., 695.
Frayer, J. M., 562, 563, 564.
Frazier, E., 891.
Fred, E. B., 398, 411, 422, 431, 711.
Freeborn, S. B., 755.
Freeman, E. M., 889.
Freeman, V. A., 461.
French, A. P., 637.
French, G. M., 808.
Frenkel, H. S., 472.
Freston, T. E., 656.
Freund, R., 80.
Friedheim, E., 202, 204.
Friedman, M. H., 28.
Friedmann, H., 751.
Friend, R. B., 59, 451, 549.
Friend, W. H., 835.
Frison, T. H., 252.
Froker, R. K., 482.
Fromme, F. D., 47, 299, 446.
Fronda, F. M., 464, 465.
Frost, K. R., 578.
Frost, S. W., 56.
Frost, W. D., 70, 471.
Frouin, A., 773.
Frumess, G. M., 96.
Fryer, J. C. F., 547.
Frysinger, G. E., 286.
Fullaway, D. T., 756.
Fuller, E., 827, 891.
Fuller, J. E., 211, 317, 318.
Fuller, J. G., 460, 462.
Fulmek, L., 851.
Fulton, B. B., 153.
Fulton, F. A., 845.
Funchess, M. J., 496.
Funk, C., 794.
Funk, E. M., 256, 279.
Funkhouser, W. D., 546.
Furth, J., 881.
Gabriel, H. S., 783.
Gadd, C. H., 240, 241.
Gahan, A. B., 552.
Gaines, E. F., 236.
Gaines, W. L., 254, 371.
Gaisberg, E. v., 543.
Gaiser, L. O., 522.
Galan, A. G., 581.
Galema, M. L., 666.
Galli-Valerio, B., 271.
Galloway, I. A., 269.
Galloway, Z. L., 278.
Gallup, W. D., 631, 663.
Galpin, C. J., 686, 687.
Gambrell, F. L., 56, 455.
Garcia, F., 299, 534.
García López, A., 651.
Gardner, F. D., 302, 303, 815.
Gardner, F. T., 779.
Gardner, M. E., 136.
Gardner, M. W., 351.
Gardner, V. R., 496, 697, 797.
Gardner, W. A., 437.
Garlock, F. L., 80, 682.
Garman, C. G., 480.
Garman, P., 56, 451.
Garner, W. W., 120, 623.
Garnett, W. E., 391.
Garrard, W. M., 883.
Garrido, J. T., 461.
Gärtner, W., 869.
Gaskill, E. F., 330.
Gaston, H. P., 84.
Gates, R. R., 325.
Gauger, H. C., 180.
Gayster, A. J., 79.
Gebhardt, H. T., 469.
Geddes, W. F., 394.
Gedroiz, K. K., 812.
Gee, N. G., 352, 546.
Geiger, R., 413.
Geiling, E. M. K., 29, 427.
Geldenhuys, F. E., 78.
Gelpi, A. J., jr., 262.
Gerber, H., 530.
Gerhard, L. K., 286.
Gerhardt, F., 629.
Gerlaugh, P., 254, 659.
Germain, L., 374.
Gersdorff, W. A., 547.
Gershoy, A., 641.
Gertler, S. I., 309.
Gerwe, E. G., 201.
Gibbens, R. T., 132.
Gibbons, C. E., 277.
Gibbs, C. S., 270, 375, 474.
Gibbs, M. A., 637.
Giblin, J., 693.
Gibson, A., 656.
Gibson, W. H., 60.
Giese, H., 405, 677.
Gieseker, L. F., 715.
Giffard, W. E., 359.
Gilbert, B. E., 214, 516, 596.
Gilbert, C. H., 157.
Gilbert, E. J., 746.
Gile, B. M., 278, 580.
Gillam, A. E., 805.
Gillette, C. C., 856.
Gillette, C. P., 399.
Gillum, I., 688.
Gilman, H. L., 265.
Gilmore, A. B., 633.
Giltner, W., 175.
Gimingham, C. T., 547.
Ginsburg, J. M., 51, 656, 847, 849.
Gisborne, H. T., 618.
Gjullin, C. M., 250.
Glanville, W. H., 74.
Glasgow, H., 50, 57.
Glasspoole, J., 618.
Glendenning, R., 654.
Glover, L. C., 846.
Gloyer, W. O., 741.
Gloyne, S. R., 669.
Goar, L. G., 727.
Godbey, E. G., 661.
Godfrey, G. H., 650, 844.
Godkin, J., 746.
Goerttler, V., 566, 870.
Goke, A. W., 117, 715.
Gokhale, V. K., 383.
Golding, J., 93, 662.
Goldschmidt, R., 626.
Goldsworthy, M. C., 840.
Gómez Clemente, F., 651.
González Ríos, P., 436.
Good, E. S., 254.
Goodey, T., 360.
Goodpasture, E. W., 270, 876.
Goodspeed, T. H., 625.
Goodwin, W., 537, 539.
Goot, P. van der, 656, 756.
Gordeeff, G. S., 79, 80.
Gordon, M. H., 471.
Górski, M., 632.
Gortner, R. A., 261, 609.
Gorton, A. F., 15, 317.
Goss, E. F., 667.
Goss, R. W., 238, 348, 843.
Gould, G. E., 156, 455, 798, 851.
Goulden, C. H., 538.
Gourley, J. H., 229, 833.
Gowan, E. H., 317.
Gowen, J. W., 724, 725.
Graber, L. F., 422, 452, 453, 458.
Gradel, W., 869.
Graf, H., 567, 568, 868, 869, 870.
Graf, R., 710.
Graham, A. R., 558.
Graham, G. M., 266.
Graham, R., 578.
Graham, S. A., 342.
Graham-Mylne, (Mrs.), 287.
Gramlich, H. J., 253.
Granovsky, A. A., 452

Gratz, L. O., 149, 749, 826.
Graue, E., 276.
Graves, P. E., 385.
Gray, C. E., 395.
Gray, J. C., 524.
Gray, L. C., 79, 580.
Gray, L. G., 415.
Gray, R. A. H., 249.
Graybill, H. W., 770, 771.
Greaney, F. J., 532.
Greathouse, G. A., 900.
Greaves, J. D., 526.
Greaves, R. E., 180.
Green, C. V., 328.
Green, E. L., 154, 652, 712, 807.
Green, R. M., 80.
Green, T. C., 619.
Greene, S. W., 254.
Greenwood, D., 363.
Gregg, W. R., 714.
Gregor, J. W., 121.
Gregory, P. W., 725.
Gregory, R., 15.
Greig, J. R., 379.
Grendel, F., 690.
Grierson, M., 220.
Griffee, F., 200.
Griffith, M. E., 696.
Griffitts, T. H. D., 656.
Grim, G. W., 866.
Grimes, J. C., 459, 460, 479.
Grimes, W. E., 80, 579.
Grinko, G. T., 386.
Grinnells, C. D., 170, 173.
Griswold, G. H., 53, 457.
Gross, A. O., 243.
Gross, E. R., 578.
Gross, J., 794.
Groves, A. B., 739.
Guba, E. F., 343, 344.
Gudjónsson, S. V., 589.
Guercio, G. del, 546.
Guerrant, N. B., 492, 493, 494.
Guest, E., 645.
Guha, B. C., 493, 612.
Guiffré, M., 710.
Guilbert, H. R., 254, 658.
Guilbert, J., 804.
Guillaumie, M., 773.
Guin, M., 188.
Gullickson, T. W., 267, 466.
Gumm, M., 70, 471.
Gunn, D., 652.
Gunnells, C., 83.
Gunness, C. I., 510, 714.
Gunstad, B., 329, 526.
Gupta, P. C., 395.
Gurwitsch, B. M., 670.
Gustafson, A. F., 620.
Gustafson, F. G., 215, 227.
Gustavson, R. G., 28, 30, 220, 227, 427.
Guthrie, E. S., 110, 262, 263, 374.
Gutiérrez-Roldán, P., 79.
Gwatkin, R., 269, 376.

Haag, A., 264.
Haas, A. R. C., 150, 232, 447, 519, 844.
Haas, L. E., 855.
Haber, E. S., 340, 635.
Hachisuka, M., 545.
Hadjinicolaou, J., 652.
Hadley, C. H., 57.
Hadley, F. B., 70, 471.
Haenseler, C. M., 842.
Häfner, I., 711.
Hagan, H. R., 650.
Haglund, E., 867.
Hahn, G. G., 543, 751.
Haigh, L. D., 422.
Hainari, T., 286.
Haines, W. C., 618.
Haley, D. E., 226, 382.
Hall, F., 777.
Hall, G. E., 96, 558, 877.
Hall, G. N., 264.
Hall, M. C., 253, 271.
Hall, M. M., 90.
Hall, O. J., 280.
Hall, R. C., 186.
Halligan, C. P., 642.
Hallman, E. T., 174, 175.
Hallock, H. C., 57.
Halloway, R. G., 12.
Halma, F. F., 232, 518.
Halnan, E. T., 65.
Halperin, M., 633.
Halpin, J. G., 258, 462, 463, 470.
Halsted, B. D., 105.
Halverson, J. O., 158, 165, 166, 467.
Halvorson, H. O., 801.
Hamer, O. S., 89.
Hamilton, A. B., 900.
Hamilton, C. C., 850.
Hamilton, C. H., 700.
Hamilton, C. L., 881.
Hamilton, C. M., 878.
Hamilton, J. M., 440, 541.
Hamilton, S. N., 33.
Hamilton, T. S., 368.
Hamilton, W. J., jr., 242.
Hamlett, G. W. D., 218.
Hammer, B. W., 67, 564, 565, 667.
Hammond, D., 624.
Hammond, W. E., 159.
Hampson, C. C., 580.
Hand, D. B., 12.
Handley, C. O., 545.
Hands, E. D., 400.
Hanna, J., 585.
Hanning, F., 372.
Hansen, A. A., 70.
Hansen, H. N., 351.
Hansen, T. S., 887.
Hansford, C. G., 646.
Hardenbergh, J. G., 70.
Hardenburg, E. V., 827.
Harding, H. A., 865.
Harding, H. G., 866.
Hardisty, E. B., 290.
Hardman, G., 720
Hardy, A. V., 671.
Hardy, G. C., 671.
Hardy, M., 897.
Hardy, M. B., 640.
Hargitt, G. T., 725.
Haring, M. M., 504, 614, 615.
Harkness, D. A. E., 79.
Harlan, J. D., 17.
Harland, S. C., 121.
Harman, S. W., 50, 58.
Harms, A. H., 669.
Harned, H. S., 609, 611.
Harper, C., 61.
Harper, H. J., 811.
Harper, J. D., 585.
Harper, R. A., 119.
Harper, V. L., 343.
Harper, W. G., 116.
Harriman, L. A., 564.
Harrington, E. S., 570
Harrington, F. M., 138.
Harrington, J. B., 820.
Harrington, W. C., 799.
Harriott, J. F., 80.
Harris, J. A., 329, 526.
Harris, L. J., 595, 896.
Harris, M. B. K., 73.
Harris, R. G., 219.
Harris, R. S., 193.
Harris, S. C., 683.
Harris, T. L., 287.
Harris, W. J., 254.
Harrison, C. A., 780.
Harrison, F., 889.
Harrison, G. J., 423.
Harrison, H. T., 317.
Harrold, E. V., 712, 737, 788.
Hart, C. P., 659.
Hart, E. B., 258, 372, 459, 462, 463, 465, 470, 893.
Hart, G. H. C., 530.
Hart, R. C., 656.
Hart, V. B., 580.
Harter, W. L., 87.
Hartley, G., 798.
Hartley, J. G., 193, 295, 803.
Hartley, P., 625.
Hartman, C. G., 27, 29, 219, 220, 427.
Hartman, H., 750.
Hartman, J. D., 827.
Hartman, W. A., 278, 580.
Hartmann, B. G., 13.
Hartzell, A., 357.
Hartzell, F. Z., 50, 56.
Harvey, A. L., 254.
Harvey, E. M., 738.
Hase, A., 851, 852.
Haseman, L., 458, 856.

Haskins, H. D., 22, 23, 339.
Haslam, R. T., 273.
Hasseltine, H. E., 865.
Hastings, E. G., 70, 469, 470.
Haterius, H. O., 219, 427.
Hatfield, I., 323.
Hathaway, I. L., 262.
Hattersley, M. C., 646.
Haury, V. G., 553.
Hausman, L. A., 448.
Hauter, L. H., 187.
Hauteserve, L. d', 483.
Hawes, C. G., 675.
Hawkins, J. H., 797.
Hawkins, R. S., 300.
Hawn, M. C., 271.
Hayden, C. C., 467.
Hayes, F. A., 17, 715.
Hayes, F. M., 873.
Hayes, H. K., 131, 324, 538, 634.
Hayes, M. W., 74.
Hays, F. A., 368.
Hays, M. B., 696.
Hazelhoff, E. H., 355.
Hazlewood, B. P., 825, 830.
Hazley, V., 501.
Headden, W. P., 717.
Headlee, M. R., 568, 569.
Headlee, T. J., 55, 454, 651, 656, 847.
Headley, F. B., 580, 767.
Heald, F. D., 750.
Hearle, E., 267.
Hecht, O., 656.
Heck, A. F., 514, 515.
Hedden, O. K., 777.
Heermann, P., 195.
Heflebower, R. B., 279.
Heilbron, I. M., 804, 805.
Heinicke, A. J., 228.
Heisig, H., 869.
Heller, V. G., 397, 556.
Helm, R., 567, 868, 869.
Helmreich, F. H., 255, 300.
Helser, M. D., 63.
Hempsall, W. H.-, 362, 657.
Henderson, E. W., 662.
Henderson, J. L., 768.
Henderson, W. W., 264.
Hendricks, W. H., 670.
Hendrickson, A. H., 41.
Hendrickson, B. H., 16.
Hendrickson, J. M., 574.
Hendry, G. W., 728.
Henika, F. S., 431.
Hening, J. C., 565.
Henley, R. R., 773.
Hennichs, B. D., 869, 870.
Henning, G. F., 883.
Henning, N., 296.
Henry, A. J., 15, 618, 713.
Henry, D. P., 876.
Henry, W. A., 602.
Hensill, G. S., 752.
Henson, E. R., 888.
Hepner, F. E., 111, 198.
Heppe, W. F., 585.
Herb, M. I., 185.
Herce, P., 651.
Hering, M., 852.
Herman, N. B., 897.
Hermansson, K. A., 869.
Herms, W. B., 752.
Herndon, L. K., 808.
Heronimus, E. S., 869.
Herrick, G. W., 53, 457.
Herrick, H. T., 411.
Herrod-Hempsall, W., 362, 657.
Hervey, G. E. R., 56.
Herzog, A., 195.
Hess, A. F., 695, 794.
Hess, E. H., 303.
Hetherington, A. C., 566.
Hetler, R. A., 397, 589.
Heukelekian, H., 781.
Heuser, G. F., 559.
Hey, G. L., 54, 654.
Heyl, F. W., 525.
Heys, F., 30.
Heywang, B. W., 560.
Hibbard, B. H., 79, 686.
Hibbard, P. L., 506.
Hickman, C. W., 255.
Hicks, C. S., 892.
Hicks, W. H., 60.
Hicock, H. W., 837.
Higgins, G. M., 463.
Hilbert, K. F., 574.
Hildebrand, E. M., 440.
Hilditch, T. P., 666, 805.
Hileman, J. L., 259.
Hill, C. L., 267.
Hill, D. D., 731.
Hill, E. B., 686.
Hill, F .F., 80, 682.
Hill, H., 25.
Hill, H. E., 121.
Hill, J. A., 62, 198, 254.
Hill, J. B., 47.
Hill, M., 29, 626.
Hill, R., 533.
Hill, R. G., 642.
Hill, R. L., 689.
Hill, W. L., 420.
Hillig, F., 13.
Hillman, V. R., 676.
Hills, J. L., 499, 516, 532, 553, 598, 888.
Himmel, W. J., 215.
Himmelreich, P., 870.
Hinshaw, W. R., 770.
Hinton, J. C., 638.
Hiratsuka, N., 347.
Hirschstein, H., 684.
Hisaw, F. L., 219, 428.
Hitchcock, A. E., 518.
Hjärre, A., 567, 775.
Hobmaier, A., 548.
Hobmaier, M., 548.
Hobson, A., 79, 600.
Hockenyos, G. L., 846.
Hockey, J. F., 543.
Hodes, H. L., 194.
Hodges, J. A., 510, 698.
Hodgson, R. W., 736.
Hoensdorf, F. S.-, 567, 870.
Hoerner, G. R., 200.
Hofer, A. W., 699.
Hofer, R. W., 422.
Hoffer, C. R., 88, 486.
Hoffer, G. N., 307.
Hofferber, O., 567.
Hoffman, A. H., 199, 777.
Hoffman, G. W., 683.
Hoffman, M. B., 499.
Hoffman, W. E., 359, 547.
Hofmann, E., 711.
Hofmeyr, J. D. J., 819.
Hogan, A. G., 254, 559.
Hogentogler, C. A., 779.
Hoggan, I. A., 247, 858.
Holben, F. J., 302.
Holland, C. S., 638.
Holland, E. B., 337, 358.
Hollingshead, L., 724.
Holloway, J. K., 157.
Holloway, T. E., 246, 356, 657.
Hollowell, E. A., 330.
Hollrung, M., 441.
Holmes, A. D., 258, 559.
Holmes, C. E., 462, 463, 470.
Holmes, F. O., 47, 536, 750, 843.
Holmes, J. A., 272.
Holmes, R. S., 18.
Holmgreen, E. N., 561.
Holmquist, A. M., 244.
Holt, R. L., 550.
Holtz, H. F., 100.
Honeywell, E. M., 595.
Hoobler, B. R., 694.
Hope, C., 748.
Hopkins, E. F., 229, 833.
Hopkins, E. S., 825.
Hopkins, E. W., 422.
Hopkins, J. A., jr., 276.
Hopkins, L. T., 89.
Hoppe, P. E., 441.
Hopper, T. H., 618.
Horák, J., 600.
Horlacher, L. J., 254.
Horn, C. L., 737.
Horn, M. J., 108.
Hornburg, P. H., 799.
Horner, J. M., 620.
Horst, K., 98.
Horsters, H., 312.
Horton, M., 889.
Horton, W. C., 259.
Horvath, A. A., 367.
Hoskins, W. M., 753.
Hosterman, W. H., 77, 577.
Hostetler, E. H., 158, 159, 160, 164, 166, 179.
Hotchkiss, W. S., 843.
Hough, W. A., 504.

Hough, W. S., 50, 739, 845.
Hourwitz, A., 834.
Houser, J. S., 845, 852.
Höve, K. R., 868.
Howard, L. O., 50, 500.
Howard, N. F., 845.
Howarth, J. A., 771, 873.
Howe, C. B., 83.
Howe, M. F., 519.
Howell, C. E., 254.
Howell, L. D., 684.
Howes, E. A., 889.
Howie, G. W., 661.
Hoy, W. A., 377.
Hruska, C., 569.
Hsu, P. C., 80.
Hubbard, J. W., 131.
Hubbard, W. H., 683.
Hubbell, R. B., 288.
Huber, M., 873.
Hubert, E. E., 15.
Huckett, H. C., 58, 332.
Huddleson, I. F., 70, 174, 265, 376, 873.
Hudson, C. B., 473.
Huebner, S. S., 683.
Huffman, C. F., 260, 468.
Hughes, A. W. M., 247.
Hughes, E. C., 736.
Hughes, E. H., 254, 255.
Hughes, J. S., 556.
Hulbert, H. W., 226.
Hull, F. E., 367.
Hull, F. H., 225.
Hull, W. W., 34.
Hultz, F. S., 62, 254, 762.
Hume, E. M., 895.
Hummel, B. L., 686.
Humphrey, E. N., 281.
Humphrey, G. C., 372, 465.
Humphreys, F. A., 268.
Humphreys, W. J., 713.
Humphries, W. R., 184.
Hungerford, C. W., 199.
Hunscher, H. A., 398.
Hunt, C. H., 397.
Hunt, G. E., 367.
Hunt, G. M., 780.
Hunter, H. C., 15.
Hunter, J. E., 882.
Hunziker, O. F., 259.
Hurd-Karrer, A. M., 214.
Hurley, T. F., 383.
Hursh, C. R., 423.
Hurst, R. R., 647.
Hurt, R. H., 40, 739.
Husain, M. A., 654, 655.
Huskins, C. L., 819.
Hussemann, D., 589.
Hussong, R. V., 67, 565.
Hutchens, H. B., 799.
Hutchinson, H. P., 544.
Hutchinson, J. B., 724.
Hutchinson, R. J., 825.
Hutchinson, W. L., 743.
Hutchison, C. B., 796.
Hutson, J. B., 579.
Hutson, J. C., 247.
Hutson, R., 456, 652, 697.
Hutt, F. B., 254.
Hutton, R., 849.
Hyde, A. M., 496, 888.
Hypes, J. L., 686.

Ikejima, H., 665.
Iljin, N. A., 523.
Iljin, V. N., 523.
Imes, M., 72.
Immer, F. R., 626.
Imms, A. D., 353, 651.
Inglis, C. C., 383.
Ingraham, A. S., 300.
Inman, L., 288.
Inman, W., 208.
Innes, J. R. M., 896.
Inouye, J. M., 108.
Insko, W. M., jr., 257, 367.
Irish, J. H., 709.
Irvin, C. J., 815.
Irwin, M. H., 289.
Irwin, R. E., 866.
Isaac, P. V., 651.
Isbell, C. L., 428, 484.
Iura, S., 684.
Ivanoff, E. J., 27.

Jack, H. W., 628.
Jack, R. W., 651.
Jackson, A. D., 899.
Jackson, C. M., 792, 892.
Jackson, H. C., 658.
Jackson, H. S., 444.
Jacob, H. E., 736.
Jacob, K. D., 420.
Jacobs, E. E., 171, 767.
Jacobson, H. G. M., 336.
Jaffa, M. E., 497.
James, D. M., 84.
James, F. C., 684.
James, L. H., 629.
James, N. L., 74.
James, W. A., 573.
Jamieson, G. S., 309, 409, 410.
Jancke, O., 851, 852.
Janisch, E., 851.
Jansen, B. C. P., 593.
Janssen, G., 721.
Jardine, J. T., 300, 699, 701.
Jarvis, E., 59.
Jarvis, T. D., 821.
Jatho, A., 714.
Jefferies, J. H., 434.
Jefferson, L. P., 86.
Jeffries, C. D., 302.
Jelinek, J., 581.
Jen, M. T., 657.
Jenkin, T. J., 121.
Jenkins, A. E., 352, 447.
Jenkins, M. T., 629.
Jenkins, S. H., 314.
Jennings, J. P., 200.
Jenny, H., 20, 518.
Jensen, C. O., 226.
Jensen, E., 79.
Jensen, H. L., 320.
Jensen, W. C., 80, 83, 187, 188.
Jesness, O. B., 79, 883.
Jeswiet, J., 530.
Johansson, E., 26, 351, 636.
Johansson, I., 424, 662.
Johns, C. K., 67, 373, 866.
Johnson, A. H., 259.
Johnson, C. C., 404.
Johnson, E. C., 185.
Johnson, E. G., 479.
Johnson, E. M., 47, 239.
Johnson, E. R., 84.
Johnson, E. W., 798.
Johnson, H. M., 175.
Johnson, H. W., 670, 873.
Johnson, I. J., 131.
Johnson, J., 132, 238, 432, 441, 645.
Johnson, J. M., 201.
Johnson, J. P., 451.
Johnson, M. B., 187.
Johnson, P. R., 843.
Johnson, R. F., 255.
Johnson, S. D., 670.
Johnson, S. E., 187.
Johnson, T., 538.
Johnson, W. T., jr., 665.
Johnston, H. B., 246.
Johnston, M. W., 792, 793.
Johnston, S., 436, 639.
Jones, A., 80, 883.
Jones, A. E., 465.
Jones, B. E., 575.
Jones, D. B., 10, 108.
Jones, D. F., 307.
Jones, D. H., 540.
Jones, D. L., 332.
Jones, E. E., 770.
Jones, F., 798.
Jones, F. S., 673.
Jones, G., 697.
Jones, G. D., 854.
Jones, H. A., 51, 52, 246.
Jones, I. D., 136.
Jones, J. H., 194.
Jones, J. M., 317, 580.
Jones, J. P., 239, 322.
Jones, L. H., 318, 323, 339, 343.
Jones, L. K., 348.
Jones, L. R., 442, 541.
Jones, M. F., 545.
Jones, M. M., 676.
Jones, R. E., 574.
Jones, W. W., 50.
Jordan, C. F., 671.
Jordan, G. L., 84.
Jordan, H. E., 426.
Jordan, P. S., 62.
Jordan, W. H., 101, 102, 103, 107, 301, 303.
Joseph, W. E., 554, 698, 761.
Joshi, N. V., 813.
Joslyn, M. A., 709, 788.

Joyeux, C., 872.
Judkins, H. F., 865.
Juhn, M., 28.
Julian, J. L., 683.
Julius, G. A., 547.
Jull, M. A., 27, 122, 560.
Justin, M., 889.
Jutila, K. T., 79.

Kaay, F. C. van der, 472, 567.
Kable, G. W., 676.
Kahai, H. S., 675.
Kalitaeva, E. M., 213.
Kalitin, N. N., 618.
Kammlade, W. G., 255.
Karacsonyi, L. P., 890.
Karny, H. H., 547.
Karper, R. E., 332.
Karrer, A. M. H.-, 214.
Kasansky, M. M., 372.
Katayama, T., 530.
Katzman, P. A., 30.
Kayser, W., 870.
Kazanskii, K. A., 244.
Kazanskii, M. M., 372.
Kazanskij, K. A., 244.
Keeler, C. E., 650.
Keenan, G. L., 11.
Keenan, J. D., 462, 463.
Keenen, F. G., 421.
Keith, J. I., 263.
Keitt, G. W., 48, 440, 541.
Kelbert, D. G. A., 438.
Keller, H., jr., 276.
Kellerman, J. H., 490.
Kelley, M. A. R., 404.
Kellogg, C. R., 546.
Kelly, H. H., 478.
Kelsheimer, E. G., 457.
Kemmerer, A. R., 459.
Kempf, G. A., 396.
Kendall, E. C., 610.
Kendrick, M. S., 388, 888.
Kennard, D. C., 257, 560.
Kennedy, C., 690.
Kennedy, P. B., 533.
Kent, V. F., 456.
Kent, W. G., 648.
Kernohan, G., 72, 573, 770.
Kertesz, Z. I., 635, 712, 807.
Key, K. M., 588.
Keyserlingk, M., 286.
Kezer, A., 33, 34, 35.
Khan, A. R., 817.
Kick, C. H., 257.
Kidd, F., 895.
Kienholz, J., 880.
Kiesselbach, T. A., 129, 346, 432, 747, 819.
Kightlinger, C. V., 344.
Kik, M. C., 494, 793.
Kikkawa, S., 628.
Kikuchi, K., 869.
Kildee, H. H., 63.
Kilpatrick, W., 888.
Kimball, H. H., 317, 618, 713, 807.
Kimbrough, W. D., 428, 434.
Kime, P. H., 170.
King, B. M., 330.
King, C. J., 748.
King, D. F., 464.
King, E. J., 96, 558, 877.
King, F. B., 789.
King, F. G., 255.
King, H. H., 246, 359, 811.
King, J. L., 157, 458.
King, J. S., 80, 580.
King, N., 640.
King, R. O., 76.
King, W. I., 578.
Kinghorne, J. W., 64.
Kinnersley, H. W., 502, 593.
Kinross, A., 257.
Kircoulesco, N. D., 581.
Kirk, H. B., 362.
Kirk, L. E., 424, 522, 531, 799, 889.
Kirk, P. L., 10.
Kirkham, W. J., 678.
Kirkland, A. H., 800.
Kirkpatrick, E. L., 481, 686.
Kirkpatrick, R. T., 332.
Kirkpatrick, T. W., 246.
Kirkpatrick, W. F., 777.
Kirkwood, T., 70.
Kitchen, C. W., 585, 607.
Kitchin, A. W. M., 584, 662.
Kittlausz, H. H., 568.
Klages, K. H., 626, 629.
Klarenbeek, A., 567.
Klarner, S., 632.
Klebahn, H., 443.
Klein, A. J., 888.
Kleine, R., 546.
Klein-Ellguth, Pfeil u., H. A. von, 537.
Kleinpaul, K. N.-, 567, 869, 870.
Klemmedson, G. S., 82.
Klepzig, V., 87.
Kletzien, S. W., 490.
Kligler, I. J., 876, 877.
Klinck, L. S., 889.
Kline, E. K., 865.
Kline, L. V., 700.
Kline, O. L., 465.
Klotz, L. J., 150, 447.
Knandel, H. C., 256.
Knapp, J. G., 188, 685.
Kneier, C. M., 686.
Knight, H., 358.
Knight, H. G., 303, 305.
Knobel, E. W., 17.
Knoblauch, H. C., 700.
Knott, J. E., 137.
Knowles, A. S., jr., 553.
Knowles, W. F., 276.
Knowlton, F. L., 885.
Knowlton, G. F., 458.
Knox, C. W., 662.
Knox, M. A., 389.
Knudson, L., 119.
Kobayakawa, K., 79.
Kobayashi, U., 586.
Kobel, M., 712.
Koch, K., 452, 453, 458.
Koch, L., 628.
Kochheiser, D. S., 259.
Kohl, E. J., 240.
Kohls, G. M., 546.
Kohman, E. F., 293, 618.
Kohn, F. J., 168.
Kokoski, F. J., 323.
Kolb, J. H., 481, 686.
Kolshorn, A., 787.
Kommers, J. B., 75.
Kondireff, L. V., 524.
Kondyrev, L. V., 524.
Koningsberger, V. J., 530.
Konishi, K., 422.
Konzo, S., 297.
Koonce, D., 33, 35.
Köppen, W., 413.
Korndorfer, A. H., 383.
Koroleff, A. N., 372.
Korolev, A. N., 372.
Korolev, S. A., 324.
Koroljeff, S. A., 324.
Koschmieder, H., 15.
Kostoff, D., 121, 521, 522.
Kotek, G., 286.
Kotila, J. E., 347.
Kovalev, N. V., 600.
Kowalke, O. L., 309.
Kozelka, A. W., 220.
Krallinger, H., 526.
Kramer, B., 893.
Kramer, M. M., 290.
Krantz, F. A., 827.
Kratz, A. P., 297.
Krauss, W. E., 97, 297, 892.
Kraybill, H. R., 38, 659.
Krewatch, A. V., 534.
Krijgsman, B. J., 266.
Kritschewski, J. L., 869.
Kritsman, L., 79.
Kronacher, C., 327.
Krotowiczówna, J., 632.
Kruse, P. J., 888.
Krynedl, F., 869.
Kuessner-Gerhard, L., 286.
Kuhlman, A. H., 663.
Kuhrt, W. J., 585.
Kulkarni, C. G., 521.
Kulkarni, G. S., 347.
Kullman, E. D., 422, 431.
Kulp, A., 683.
Kunde, M. M., 30, 427.
Kunkel, L. O., 446, 649.
Kurzrok, R., 27.
Kuwana, I., 756.
Kuwana, S., 756.
Kylasamaier, K., 573.

Lacroix, D. S., 336, 356.
Lacy, I. O., 781.

Ladd, C. E., 889.
Ladd, J. E., 659.
La Follette, R. M., 604.
Lagassé, F. S., 228.
Laidlaw, P. P., 270, 472, 572.
Laing, H. E., 227.
LaMaster, J. P., 371.
Lamb, A. R., 700.
Lamb, C. A., 699.
Lamb, P. H., 345.
Lambert, W. V., 254.
Lamiman, J. F., 753.
Lamon, H. M., 64.
Lamson, P. D., 568.
Landauer, W., 254, 425, 523, 764.
Lane, C. H., 585.
Lane, M. C., 58.
Lange, L., 852.
Langelier, G. A., 60.
Lantz, E. M., 596.
Lantz, H. L., 879.
Lapham, I. A., 317.
Lapsley, A. B., 545.
Larmour, R. K., 532.
Larrimer, W. H., 845.
Larson, I., 217.
Laskowski, B. R., 317.
Laskowski, M., 772.
Lathrop, A. W., 462.
Lathrop, F. W., 190.
Latimer, L. P., 341.
Lattimer, J. E., 78, 81.
Lattimer, J. L., 889.
Laude, H. H., 698.
Lauder, A., 529.
Laug, E. P., 206.
Lauprecht, E., 122, 523.
Laur, E., 578, 579, 582.
Laurie, A., 641.
Lauritzen, J. I., 636.
Lavanchy, G., 230.
Lavergne, A. de, 684.
Lawlah, J. W., 122, 217.
Layton, D. V., 149.
Layton, M. H., 417.
Leach, D., 277.
Leach, J. G., 360.
Leach, L. D., 49.
Learmonth, R., 499.
Leatherman, M., 614.
Lebedeff, G. A., 425.
LeDuc, P. W., 773.
Lee, A., 238.
Lee, A. M., 73.
Lee, J. G., jr., 497.
Lee, L. L., 116.
Lee, V. P., 389.
Leech, H. B., 355.
Leefmans, S., 58, 756.
Leete, C. S., 865.
Lefebvre, C. L., 249.
Leggatt, C. W., 39.
Legge, A., 499, 585, 888.
Lehman, R. T., 798.
Lehman, S. G., 145.
Leipert, T., 711.
Leitch, F. M., 671.
Leith, B. D., 431.
Leng, C. W., 57.
Lentz, J. B., 375.
Leonard, G. F., 377.
Leonard, M. D., 50, 457, 851.
Leonard, S. L., 219.
Lepkovsky, S., 613.
Lepper, H. A., 190.
Lerch, R., 388.
le Roux, J. C., 709.
Leslie, J. B., 657.
Leslie, R. F., 866.
Lesses, M. F., 792.
Lestoquard, F., 776, 877.
Levin, L., 30.
Levin, W., 571.
Levine, M., 43.
Levine, M. N., 236.
Levy, M., 202.
Lewek, G., 868, 869.
Lewin, C. J., 528.
Lewis, E. A., 773.
Lewis, E. B., 575.
Lewis, M. R., 272, 477.
Lewis, M. S., 690.
Lewis, R. C., 94, 96, 894.
Lewis-Faning, E., 625.
Li, H. W., 818.
Lieb, C. C., 27.
Light, S. F., 546.
Likhité, V., 645.
Lill., J. C., 433.
Lilleland, O., 421, 736.
Lillie, R. D., 571.
Lilly, C. H., 566.
Liming, O. N., 448.
Lin, Y. Y., 546.
Lind, S. G., 287.
Lindblom, A., 552.
Lindsay, M. A., 254.
Lindsey, A. W., 655.
Lindsey, J. B., 337, 370, 767.
Lindstrom, D. E., 586.
Lindstrom, E. W., 624.
Linfield, F. B., 698.
Linford, M. B., 548, 844, 852.
Ling, A. W., 225, 226.
Lininger, F. F., 79, 189.
Link, G. K. K., 746.
Lintzel, W., 690.
Lipman, J. G., 302, 621, 810, 824, 899.
Little, R. B., 673.
Little, V. A., 547, 846.
Livingston, B. E., 24, 212.
Livingstone, E. M., 155.
Lloyd, E. M. H., 78.
Lloyd, F. E., 120.
Lloyd, J. R., 317.
Lochhead, A. G., 67.
Locklin, H. D., 138, 640.
Lodewick, J. E., 42.
Loeffel, W. J., 660.
Loftin, U. C., 200.
Logan, C. A., 677.
Logue, P., 890.
Löhnis, M. P., 446.
Loman, H. J., 683.
Lomunoff, A. A., 372.
Lomunov, A. A., 372.
Long, J. D., 404, 777.
Longenecker, J. B., 226.
Longley, L. E., 228.
Longley, W. V., 889.
Longwell, J. H., 367.
Loomis, H. F., 748.
López, A. G., 651.
Lopez, A. W., 551.
Lord, E. C. E., 779.
Lorimer, M., 844.
Lothrop, R. E., 408.
Lotka, A. J., 686.
Lott, R. V., 139.
Lou, J. C., 652.
Loughridge, R. H., 406.
Lounsbury, C., 417.
Lovell, O. H., 754.
Lovell, R., 377.
Lovell, W. G., 274.
Lowdermilk, W. C., 575.
Lowry, B., 400.
Lowry, P. R., 200, 846.
Lucas, W. P., 693.
Luce, W. A., 138.
Lucey, J., 662.
Luchinetti, F., 568.
Luckiesh, M., 195.
Lund, E. J., 643.
Lundblad, O., 550.
Lunn, A. G., 885.
Lunt, H. A., 814.
Lush, J. L., 253, 426, 759.
Lush, R. H., 66, 663.
Lutman, A. S., 532.
Luxford, R. F., 779.
Lyle, C., 349.
Lyle, G. T., 252.
Lyle, S. P., 403.
Lyness, W. E., 432.
Lynott, M. L., 363.
Lyon, T. L., 621.

McAlpine, J. G., 266, 777.
McAtee, W. L., 50.
McAuliffe, J. P., 807.
MacBride, E. W., 725.
McBryde, J. M., 406.
McCall, F. J., 264.
McCapes, A. M., 72.
McCarthy, J. B., 672.
McClary, J. A., 60.
McClelland, C. K., 324, 633, 730, 825, 826.
McClelland, T. B., 741.
McClintock, B., 121, 818, 819.
McClintock, J. A., 150, 350, 351, 799, 830, 840.
McClure, F. J., 366.

McClurg, R. J., 808.
McColly, H. F., 39, 184.
McConnell, H. S., 453.
McCorkle, W. H., 615.
McCormick, C. H., jr., 401, 499.
McCormick, T. C., 900.
McCosh, S. S., 398.
McCracken, C. C., 497.
McCreary, O. E., 160.
McCue, C. A., 436, 888.
McDaniel, E. I., 456, 757.
MacDonald, A. D., 671.
Macdonald, R. A. S., 568.
McDonald, W. F., 808.
MacDougall, R. S., 852.
McEwen, A. D., 472.
McEwen, G. F., 15.
McFadden, E. S., 37, 325.
McGehee, T. F., 126, 698.
McGeorge, W. T., 417.
McGilliard, P. C., 260.
McGinnies, W. G., 300.
McGregor, E. A., 59, 357.
Machali, M., 111.
McIndoo, N. E., 253.
McIntyre, A. C., 837.
McIntyre, C. W., 562.
Mack, M. J., 68, 394.
McKay, A. W., 79, 585.
McKay, F. S., 396.
McKee, C., 698.
McKee, M. A., 892.
McKee, R., 37, 223.
McKeehen, J. E., 16.
McKendrew, E. L., 683.
McKenzie, B. F., 610.
McKenzie, F. F., 254.
Mackenzie, W. A., 223.
McKibben, E. G., 275, 577.
McKibbin, I. M. W., 894.
Mackie, W. W., 345, 728.
McKim, E., 890.
McKinney, H. H., 538, 645.
McKinnon, L. R., 421.
McLaughlin, A. R., 70, 571.
McLaughlin, F. A., 38.
McLean, D. D., 352.
Macleod, A. L., 392.
MacLeod, D. J., 347, 826.
McNabb, A. L., 267.
McNair, A. D., 223.
McNall, P. E., 481, 482.
McNutt, S. H., 265, 267.
Macoun, W. T., 307, 889.
McPhee, H. C., 26, 254.
McPherson, J. B., 366.
McRae, W., 441.
Macy, I. G., 398.
Madill, A. J., 89.
Madsen, D. E., 670.
Madson, B. A., 727, 777.
Magee, C. F., 671.
Magie, R. O., 440.
Magill, M. A., 806.
Magistad, O. C., 620, 622.
Magness, J. R., 138.
Magruder, R., 435.
Mahdihassan, S., 547.
Mail, G. A., 851.
Mains, E. B., 45, 542, 543.
Majmudar, V. M., 581.
Major, T. G., 46.
Malkani, P. G., 250.
Mallmann, W. L., 180, 623, 881.
Maltby, R. D., 190.
Manalang, C., 550.
Mangelsdorf, P. C., 216.
Mann, A. R., 200, 499, 686.
Mann, H. B., 118.
Mann, H. H., 347.
Mann, R. F., 847.
Manning, J. R., 254, 397.
Manninger, R., 870.
Manny, T. B., 85, 686.
Manson, R. W., 575.
Marble, D. R., 523.
Marbut, C. F., 302, 484.
Marchal, E., 45.
Marchionatto, J. B., 539.
Marcovitch, S., 253, 458, 850.
Marcus, J. K., 410.
Marcussen, W. H., 865.
Margary, I. D., 414, 809.
Maris, P. V., 889.
Markley, K. S., 638, 739.
Markwardt, L. J., 42.
Marlatt, A. L., 889.
Marquardt, J. C., 373, 374, 866.
Marr, G. A., 807.
Marrero, J. F., 813.
Marsh, C. D., 177.
Marsh, G. L., 709, 788.
Marshall, G. E., 249.
Marshall, H. L., 420.
Marshall, R., 414, 809.
Marshall, R. E., 140.
Marston, A., 889.
Marston, A. R., 433.
Martin, H., 537.
Martin, J. A., 572.
Martin, J. B., 505.
Martin, J. C., 318.
Martin, J. F., 338.
Martin, J. H., (Ky.), 257, 367.
Martin, J. H. (U. S. D. A.), 33, 223.
Martin, W. H., 826, 827, 837.
Marvin, C. F., 15.
Marvin, G. E., 856.
Mason, C. W., 309.
Mason, H. L., 610, 611.
Massey, R. E., 646.
Math, F. A., 807.
Mather, S., 300.
Mathes, R., 456.
Matheson, R., 876.
Mathews, F. P., 259.
Matlock, R. L., 300.
Matsumoto, T., 535.
Matsumura, S., 756.
Matters, R. F., 892.
Matthews, A. E., 116.
Matthews, W. A., 227.
Mattice, W. A., 15, 317, 617, 618.
Mattill, H. A., 203, 205, 309.
Mattson, S., 513.
Maudsley, C., 595.
Maurmann, G., 567.
Mautner, B. H., 278.
Maw, W. A., 757.
Maximow, N. A., 120.
Maxwell-Darling, R. C., 246.
May, C., 448, 543.
May, O. E., 411.
Mayer, L. S., 825.
Mayfield, H. L., 698.
Maynard, L., 261.
Maynard, L. A., 254.
Maynard, R. S., 864.
Mayoral Reinat, A., 436.
Mayton, E. L., 428.
Meacham, F. B., 153.
Mead, E., 404.
Mead, S. W., 658.
Meade, DeV., 868.
Meador, D. J., 176.
Medlar, E. M., 871.
Megee, C. R., 628.
Mehl, J. M., 684.
Mehta, M. M., 297.
Meier, K., 833.
Melchers, L. E., 538, 539.
Meldrum, N. U., 310.
Melhus, I. E., 48, 149, 237.
Melis, A., 546.
Mellanby, E., 396.
Mellor, J. E. M., 58.
Melvin, B. L., 687, 785.
Melvin, R., 50.
Menard, D. F., 559.
Mendel, L. B., 98.
Mendenhall, D. R., 491.
Menendez, P. E., 73.
Menos, J., 468, 665.
Menozzi, C., 52.
Merchant, C. H., 189.
Merkle, F. G., 302.
Merrill, E. D., 500.
Merrill, M. C., 889.
Merritt, P. P., 890.
Mervine, E. M., 275.
Merwe, C. R., van der, 533.
Metcalf, F. P., 151.
Metcalf, Z. P., 153, 242, 888.
Metcalfe, C. R., 649.
Mettam, R. W. M., 472.
Metz, C. W., 425.
Metzelaar, J. T., 628.
Metzger, F. W., 847.
Meyer, A. H., 816.
Meyer, C. R., 397, 589.
Meyer, F., 567.
Meyer, H., 710.
Meyer, K. F., 569.

Meyer, R. K., 219, 428.
Michael, S. T., 770, 771.
Michaelis, L., 202, 204, 213.
Michelet, M., 287.
Michelmore, A. P. G., 246.
Mickle, F. L., 866.
Mielck, O., 387.
Migge, 868.
Milam, A. B., 599.
Milbrath, D. G., 446.
Miles, H. W., 247, 656.
Miller, C. D., 793.
Miller, D. G., 575.
Miller, E. G., jr., 92.
Miller, E. J., 412, 413.
Miller, E. R., 316, 317, 510, 807.
Miller, F. W., 656, 847.
Miller, H. K., 597.
Miller, J. N., 411.
Miller, M. F., 698.
Miller, M. R., 177, 668.
Miller, N. C. E., 547.
Miller, P. A., 148, 317.
Miller, P. L., 79.
Miller, R. F., 365, 660.
Miller, R. L., 454.
Miller, S. B., 471.
Miller, T. A. H., 479.
Mills, A. M., 259.
Mills, A. S., 457, 851.
Mills, H. S., 635.
Milnor, G. S., 585.
Milward, J. G., 441.
Mitchell, C. A., 268.
Mitchell, D. R., 482.
Mitchell, H. H., 254, 366, 368.
Mitchell, M. L., 892.
Mitchell, T. B., 153.
Mitchener, A. V., 552.
Mitra, M., 344.
Mitrofanov, A. S., 529.
Miyazawa, B., 521.
Moe, A., 414.
Moffett, H. C., 254.
Mohammad, A., 529.
Moir, M., 257.
Moir, W. W. G., 531.
Moise, T. S., 794.
Molinari, L., 248.
Molisch, H., 517.
Monroe, C. F., 97, 467, 889.
Monteith, J., jr., 43, 44.
Montreuil, J. E., 46, 60.
Moody, R. I., 469, 562.
Mooers, C. A., 825, 899.
Moore, A. N., 278.
Moore, C. R., 329.
Moore, H. C., 433, 496, 633.
Moore, H. R., 389, 481.
Moore, L. A., 260.
Moore, R. B., 806.
Moore, W. B., 258.
Morcos, Z., 881.
Morey, H. F., 816, 842.
Morgan, A., 220, 821.
Morgan, A. F., 789.
Morgan, B. G. E., 588.
Morgan, C. L., 556.
Morgan, D. O., 572.
Morgan, M. F., 336.
Morison, F. L., 389.
Morris, H., 572.
Morris, H. E., 138.
Morris, J. P., 310.
Morris, L., 556.
Morris, M. H., 220.
Morris, V. H., 35, 129.
Morrow, K. S., 200.
Morse, F. W., 318.
Morstatt, H., 644.
Mortimer, G. B., 431.
Morton, R. A., 804, 805.
Moser, R. E., 799.
Moses, B. D., 575.
Moss, H., 76.
Mossman, H. W., 217.
Moszczenski, S., 579.
Mottern, H. H., 408.
Moutia, A., 56.
Mowry, H., 232.
Moxley, H. F., 254.
Moyer, T. R., 816.
Mrak, E. M., 110, 709.
Mrskosova (Mrs.), 286.
Muchlinsky, 567.
Mudge, C. S., 768.
Mueller, W. S., 372, 799.
Muir, F. A. G., 497.
Mukherjee, H. N., 395.
Mulay, A. S., 639.
Müller, F., 868.
Muller, H. R. A., 649.
Muller, J. F., 516.
Mumford, F. B., 422, 698.
Mumford, H. W., 888.
Mumm, W. J., 521.
Munce, T. E., 70, 267.
Munch, J. C., 151.
Muncie, J. H., 43, 48.
Mundinger, F. G., 56.
Mundkur, B. B., 347.
Munkwitz, R. C., 868.
Munro, J. A., 853.
Munro, W. A., 60.
Munzarová, A., 600.
Murdock, H. E., 576, 879.
Murneek, A. E., 25, 229.
Murphy, J. R., jr., 528.
Murray, A. M. T., 290.
Murray, C., 267, 674.
Murray, J. M., 425.
Murray, K. A. H., 662.
Murray, T. J., 568.
Murwin, H. F., 132.
Musbach, F. L., 435.
Muse, M., 688.
Musgrave, G. W., 320.
Mussehl, F. E., 559, 862.
Mutten, G., 667.
Myers, J. A., 267.
Myers, P. B., 407.
Myers, R. P., 259.
Myers, W. I., 80.
Mylne, G.-, (Mrs.), 287.

Nabours, R. K., 217, 520.
Naftel, J. A., 23, 322.
Nagl, F., 868.
Nakayama, S., 756.
Nason, E. H., 392.
Nattrass, R. M., 544.
Naumann, H. N., 713.
Navarrete, J. B., 15.
Navashin, M., 724.
Neal, D. C., 45, 899.
Neal, J. H., 509.
Neal, W. M., 254, 467.
Neatby, K. W., 538.
Nebel, M. R., 699.
Needham, J. G., 546.
Neel, L. R., 825, 856, 861.
Neely, J. W., 730.
Neil, B., 91.
Neilson, J., 498.
Neiswander, C. R., 154, 456.
Neller, J. R., 230, 342.
Nelson, A. L., 739.
Nelson, E. K., 408.
Nelson, E. M., 397.
Nelson, E. W., 242.
Nelson, J. A., 667.
Nelson, J. R., 243.
Nelson, M., 732.
Nelson, M. N., 282.
Nelson, P. M., 289.
Nelson, P. R., 767.
Nelson, T. C., 751.
Nelson, V. E., 395.
Nelson, W. O., 219, 329, 427.
Nesbitt, L. L., 618.
Neuberg, C., 711, 712.
Neumann-Kleinpaul, K., 567, 869, 870.
Neumayer, L., 568.
Neupert, E. F., 525.
Nevens, W. B., 255, 561.
Newbigin, H., 257.
Newburgh, L. H., 792, 793.
Newell, W., 496.
Newlander, J. A., 664.
Newman, H. H., 220.
Newman, J. E., 384.
Newman, L. F., 225.
Newman, L. J., 551.
Newsom, I. E., 72, 572.
Newton, G. A., 138.
Newton, H. C. F., 552.
Newton, M., 538.
Newton, R., 346.
Newton, R. G., 60.
Newton, R. W., 388.
Nicholls, L., 268.
Nichols, H. E., 662.
Nichols, M. L., 404, 476, 479.
Nichols, N. N., 200.
Nichols, P. F., 709, 737, 755.
Nicolas, G., 242.

Nicolau, S., 269.
Nicolet, B. H., 11.
Nieberle, K., 567.
Niemann, K. W., 662.
Niethammer, A., 24.
Niimi, D., 568.
Nimtz, A., 868.
Nixon, M. W., 576.
Noble, C. V., 480, 886.
Noble, W. B., 457.
Nodon, A., 111.
Nolan, M. O., 650.
Noll, C. F., 302, 815.
Nolla, J. A. B., 349.
Nonnenmacher, E., 34.
Norris, E. R., 95.
Norris, J. C., 872.
Norris, L. C., 559.
North, D. S., 441.
North, M. O., 462.
Norton, E. A., 117, 811.
Norton, J. B. S., 129.
Norton, J. E., 527.
Norton, L. J., 79.
Nourse, E. G., 79, 685.
Novaes, J. de C., 251.
Nuckolls, S. B., 35.
Nussmeier, M., 595.
Nye, G. W., 748.
Nygard, I. J., 19.

Oakley, R. A., 800.
O'Brien, H., 206.
O'Brien, R., 889.
Ocampo, M., 292.
Ochs, G., 547.
O'Connor, B. A., 551.
O'Donnell, F. J., 546.
Oertel, E., 856.
Offner, M. M., 893.
Offord, H. R., 448.
Ogden, H. P., 825, 830.
Ogden, W. B., 132, 431.
Ogura, K., 665.
O'Hara, E. V., 686.
Ohyama, T., 894.
O'Kane, W. C., 846.
O'Kelly, J. F., 34.
Okey, R., 13.
Olcovich, H. S., 203.
Oldham, J. N., 551.
Oley, W. W., 585.
Oliveira Castro, G. M. de, 250.
Oliveira, J., 844.
Oliveiro, C. J., 310.
Oliver, A. R., 808.
Oliver, A. W., 861.
Olmstead, L. B., 716.
Olney, R., 405.
Olsen, N. A., 80, 585.
Olson, F. C., 367.
Olson, O., 226.
Olsson, T., 867.
O'Neal, A. M., 208, 718.
Ong, E. R. de, 846.
Onslow, M. W., 212.
Orcutt, M., 673.
O'Roke, E. C., 352.
Orr, J. B., 307.
Orten, J. M., 894.
Orton, C. R., 44, 543.
Orwin, C. S., 482.
Osborn, H., 247, 845.
Osmun, A. V., 339.
Otter, K., 568.
Overholser, E. L., 640.
Overley, F. L., 138, 154, 652.
Overpeck, J. C., 36.
Oveson, M. M., 322.
Owen, B. B., 609, 611.
Owen, N., 233.
Owen, W. B., 151.
Owens, J. S., 337.

Pagliano, T., 253.
Paine, H. S., 408.
Paine, W. H., 426.
Paje, P. S., 464, 465.
Palmer, H. S., 512.
Palmer, L. S., 261, 267, 690.
Palmer, W. B., 865, 866.
Palmiter, D. H., 440.
Pammel, L. H., 101, 105, 106, 107.
Panchard de Bottens, S., 286.
Parfitt, E. H., 110, 666.
Park, J. W., 85.
Parker, H. L., 156.
Parker, H. N., 865.
Parker, J. H., 798.
Parker, K. W., 128.
Parker, M. E., 259.
Parker, M. M., 851.
Parker, M. W., 900.
Parker, R. R., 267, 546.
Parkes, A. S., 29, 30.
Parks, H. B., 899.
Parks, R. R., 881.
Parks, W. J., 709.
Parman, D. C., 453.
Parr, V. V., 253.
Parris, G. K., 854.
Parrot, L., 776.
Parrott, P. J., 50.
Parsons, H. T., 489.
Parsons, K. H., 481.
Partridge, N. L., 436, 740.
Pasquier, R. du, 756.
Patch, A. J., 496, 697.
Pate, W. W., 100, 415.
Patel, M. K., 234.
Paton, R. R., 837.
Patrick, A. L., 302.
Patt, E. M., 38.
Patten, B. M., 556.
Patterson, C. F., 642.
Patterson, H. J., 99, 303.
Patton, W. S., 244.
Patty, R. L., 76.
Pawan, J. L., 353.
Peacock, W. M., 508, 827, 891.
Pearce, G. W., 52.
Pearson, H., 580.
Pearson, J. H., 190.
Pearson, O. H., 137.
Pearson, T. G., 544.
Pederson, C. S., 807.
Peet, L. J., 289.
Peltier, G. L., 148.
Pember, F. R., 516.
Pemberton, (Mrs.), 287.
Pénau, H., 804.
Pendlebury, H. M., 548.
Penman, F., 647.
Perez, M. Q., 651.
Perkins, A. J., 281, 583.
Perkins, A. T., 811.
Perkins, E. B., 751.
Perry, E. J., 561.
Perry, E. P., 419.
Perry, R. L., 778.
Perry, W. M., 737.
Persse, A. A., 662.
Pessinger, 870.
Petch, T., 537.
Peter, P. N., 263.
Peters, H. S., 548.
Peters, R. A., 501, 502, 593.
Peters, W. H., 62, 254, 365.
Peters, W. J., 316.
Peterson, M. W., 90, 91.
Peterson, W. H., 12, 398, 411, 422, 490, 491, 711.
Petherbridge, F. R., 54, 648, 654.
Petre, A. W., 843.
Petro, V. A., 789.
Pettee, D. A., 68.
Pettit, R. H., 153, 458, 652.
Pfeil u. Klein-Ellguth, H. A. von, 537.
Pfiffner, J. J., 219, 329.
Pfund, A. H., 76.
Phelan, V. B., 299.
Philbrick, B. G., 669
Phillips, E. F., 855.
Phillips, M., 409.
Phillips, R. W., 254.
Phipps, C. R., 756.
Picard, F., 657.
Pickett, W. F., 698.
Pierce, W. D., 546, 547, 552, 651.
Pieri, J., 872.
Pierre, W. H., 209.
Pigott, M. G., 258, 559.
Pinckney, A. J., 618.
Pincus, G., 28.
Pingree, D., 186.
Piper, C. S., 119.
Pirie, E. E., 90.
Pitman, G. A., 709, 710.
Pittman, D. W., 226, 627, 843.
Pittman, H. A., 345.
Pivny, A. de P., 583.

Plastridge, W. N., 266.
Platt, C. S., 465.
Plessis, A. F. du, 684.
Plum, N., 269.
Poel, J. van der, 531.
Pohlman, G. G., 418.
Póka-Pivny, A. de, 583.
Polivka, J. B., 457.
Polson, R. A., 790.
Pomeroy, C. S., 640.
Pond, G. A., 282, 579.
Pontius, B. E., 254, 379.
Poole, C. F., 724.
Poole, R. F., 146, 540.
Poos, F. W., 455.
Pope, J. D., 480.
Pope, W. T., 737.
Popoff, M., 119.
Porcher, C., 261.
Porri, V., 684.
Porter, A. B., 647.
Porter, D. R., 237, 239, 240.
Porter, R. H., 235, 237.
Post, A. H., 698.
Posthumus, O., 531.
Postl, E., 870.
Potter, E. L., 160, 659.
Potter, G. F., 341.
Potter, M. T., 290.
Pötting, B., 870.
Potts, C. K. H. C., 628.
Potts, S. F., 453.
Poulson, E. N., 117.
Pourtales, J. H. von, 693.
Powell, B. B., 534.
Powell, H. C., 42.
Powell, T. E., jr., 758.
Power, F. D., 547.
Powers, A. J., 259.
Powers, W. H., 189.
Powers, W. L., 322, 575, 740, 815.
Prado, M., 378.
Pratt, A. D., 92.
Pratt, E. H., 286.
Preisler, D. B., 204.
Preisler, P. W., 204.
Prentice, J. H., 894.
Price, D., 329.
Price, H. B., 79, 185.
Price, W. T., 226.
Price, W. V., 173, 374.
Prickett, L. C., 560, 576.
Prickitt, H. N., 656.
Priestley, F. W., 376.
Prince, A. L., 621.
Priode, C. N., 349.
Pritchard, E. W., 533.
Proper, A. B., 758.
Pröscholdt, O., 567, 869.
Prosoroff, S. S., 852.
Proudfit, F. T., 890.
Prucha, M. J., 373.
Pruess, L. M., 398.
Pruett, W. C., 273.
Pryor, H. B., 693.
Publow, C. A., 799.
Pucher, G. W., 9, 36.
Pugh, C. E. M., 311.
Pugh, E., 303.
Pugsley, L. I., 672.
Pulley, H. C., 720.
Purchase, H. S., 473.
Puri, A. N., 211, 505, 506, 813.
Purwin, P., 265, 267.
Pussard, R., 657.
Putnam, E. H., 341.
Putnam, G. W., 865.
Pyle, J. F., 683.

Quayle, H. J., 549.
Quigley, G. D., 861.
Quilis Perez, M., 651.
Quin, P. J., 709.
Quinby, J. R., 332, 631.
Quinet, R., 174.
Quinn, E. J., 193, 295, 803.
Quinn, J. P., 122.
Quirke, T. F., 375.
Quisenberry, K. S., 37.

Rabaté, E., 800.
Rader, L. F., jr., 420.
Raistrick, H., 566.
Raj, D., 655.
Raleigh, W. P., 235.
Ram, G., 655.
Ram, K., 530.
Ram, L., 655.
Ramakrishna Ayyar, T. S., 240.
Ramakrishnan, T. S., 241.
Ramiah, K., 522.
Ramsdell, G. A., 665.
Ramser, C. E., 274.
Randall, G. O., 136.
Randolph, J. W., 476.
Rankin, A. C., 571.
Rankin, W. H., 323, 447, 543.
Rao, G. G., 418.
Raphael, T. D., 833.
Rapoport, M., 194.
Rasch, K., 675.
Rasmussen, F., 865.
Rassfeld, L., 870.
Rastaedt, H., 869.
Rastegaieff, E. F., 777, 870.
Rather, H. C., 34.
Rauchenstein, E., 86, 483.
Rawlins, L. M. C., 9.
Ray, C. L., 807.
Rea, H. E., 817.
Read, G. A., 256.
Reader, V., 593, 594.
Reagel, F. V., 478, 575.
Records, E., 775, 870, 873.
Redington, P. G., 242.
Reed, C. D., 808.
Reed, H. J., 52, 56, 198.
Reed, H. M., 737.
Reed, H. S., 755.
Reed, I. F., 184.
Reed, W. D., 357.
Rees, L. W., 42.
Rees, R. I., 889.
Reese, M. J., 888.
Regan, W. S., 654.
Regendanz, P., 773.
Reichart, E. L., 667.
Reichenow, E., 773.
Reid, M. E., 517.
Reimers, J. H. W. T., 62.
Reinat, A. M., 436.
Reinecke, O. S. H., 40.
Reinhard, H. J., 899.
Reitler, I., 683.
Renfrew, A. G., 205.
Renick, B. C., 778.
Reppin, K., 868.
Rettger, L. F., 211, 777.
Reuszer, H. W., 31.
Reynolds, F. H. K., 550.
Rhoades, E. L., 255.
Rhoades, M. M., 625.
Rhode, C. S., 479.
Rhodes, F. H., 779.
Rhodes, H., 853.
Rich, L. H., 268.
Richards, B. L., 44, 238.
Richards, D. E., 583.
Richards, H. I., 276.
Richards, M. B., 192.
Richardson, A. E., 90.
Richardson, C. H., 855.
Richardson, G. A., 262, 768.
Richardson, H. H., 851.
Richardson, H. L., 270.
Richert, P. H., 110, 709.
Richey, F. D., 625.
Richey, H. W., 231.
Richter, C., 208, 712, 715, 737.
Rickett, H. W., 23.
Riddle, O., 525.
Ridruejo, L., 651.
Rieman, G. H., 327.
Riggs, O. B., 798.
Rightmire, G. W., 888.
Riker, A. J., 44, 48, 440, 841.
Riker, R. S., 541.
Riley, H. K., 798.
Riley, J. A., 317.
Riley, W. A., 381, 599.
Rinehart, E. F., 255.
Ringrose, A. T., 559.
Rintoul, M. L., 566.
Rintoul, W., 566.
Ríos, P. G., 436.
Ripperton, J. C., 712, 737
Ritchie, A. H., 547.
Ritchie, J. H., 224.
Ritter, K., 284.
Ritzman, E. G., 857.
Rivera, V., 26.
Rivnay, E., 247.
Roadhouse, C. L., 262, 768, 866.
Roark, R. C., 50, 359, 846
Robb, B. B., 403, 575.

Robb, E., 290.
Robbins, E. T., 254.
Robbins, P. W., 437.
Robbins, W. J., 23, 213.
Robbins, W. R., 830.
Robert, J. C., 31, 99.
Roberts, E. H., 197.
Roberts, F. H. S., 551, 776.
Roberts, O. C., 340.
Roberts, O. S., 38.
Roberts, R. A., 250.
Roberts, R. E., 257, 259.
Roberts, R. H., 40.
Roberts, R. S., 472.
Robertson, A. H., 562, 563, 564.
Robertson, D. W., 33, 34, 35.
Robertson, G. S., 257.
Robertson, I. M., 529.
Robertson, W. R. B., 217, 328.
Robey, O. E., 479.
Robinson, A. B., 889.
Robinson, B. B., 224.
Robinson, C. S., 260, 799.
Robinson, J. M., 449.
Robinson, R., 566.
Robinson, W. J., 422.
Robison, O. J., 554.
Robison, W. L., 166, 255.
Roche, B. H., 255, 460, 462, 466.
Rockwood, L. P., 758.
Rodenhiser, H. A., 842.
Roderick, L. M., 267.
Roe, H. B., 509.
Roemmele, 399.
Rogers, H. W., 659.
Rogers, L. A., 411.
Rohde, G., 330, 337.
Roldán, P. G., 79.
Roller, E. M., 514.
Romanoff, A. L., 259.
Romanov, N. A., 869.
Root, C. J., 15.
Roscoe, M. H., 586, 590, 591.
Rose, D. C., 808.
Rose, M. S., 290, 292, 395.
Rosedale, J. L., 310.
Rosell, J. M., 268.
Rosen, H. R., 238.
Rosenberg, L. C., 692.
Rosenfeld, A. H., 531.
Rosenow, E. C., 271.
Rosenquist, C. E., 624, 634.
Ross, B. B., 199.
Ross, H. A., 79.
Ross, H. H., 657.
Ross, W. A., 190.
Ross, W. H., 420.
Roth, R. O., 255.
Roubaud, E., 250, 758.
Roux, J. C. le, 709.
Rowaan, P. A., 531.
Rowe, A. H., 890.
Rowe, W. H., 682.
Rowley, H. K., 635, 734.
Rowntree, J. I., 295, 793.
Rucks, W., 674.
Rude, C. S., 851.
Rude, R., 261.
Rudel, H. W., 504.
Rudolfs, W., 781.
Rudolph, B. A., 147.
Ruehe, H. A., 373, 479.
Ruehle, G. D., 750.
Rueble, G. L. A., 669.
Ruffner, R. H., 170, 173.
Ruggles, A. G., 599.
Rumreich, A., 59.
Runnels, H. A., 338.
Rupel, I. W., 254, 465, 466.
Ruprecht, R. W., 415, 429, 434.
Rusk, H. P., 255.
Russell, B. A., 80, 187.
Russell, H. E., 259.
Russell, H. L., 602, 603.
Russell, R. J., 315.
Russell, W. T., 625.
Ruston, A. G., 80, 662.
Rutherford, W. J., 385.
Rutledge, R. M., 285.
Ruttledge, W., 246.
Ruzek, C. V., 815.
Rydberg, P. A., 500.
Ryerson, K. E., 889.
Rygg, G. L., 740.
Ryker, T. C., 828.

Sacay, F. M., 80.
Sachsse, H., 802, 803.
Sabyun, M., 202.
St. John, J. H., 550.
St. John, J. L., 891.
St. Julian, R. R., 397.
Sakimura, K., 835.
Saling, W. M., 779.
Salmon, E. S., 537, 539.
Salmon, S. C., 497, 608, 734.
Salmon, W. D., 471, 492, 493, 494.
Salter, F. J., 514.
Sammis, R. H., 656.
Sampson, A. W., 128.
Sampson, H. C., 888.
Sampson, K., 539.
Samuel, G., 119, 645.
Samuels, C. D., 358.
Samuels, L. T., 317, 714.
Sanborn, R., 368.
Sanders, D. A., 472.
Sanders, H. G., 66.
Sanders, J. T., 278, 285.
Sanderson, D., 686, 687.
Sanderson, W. R., 657.
Sandiford, I., 395.
Sando, C. E., 612, 638, 739.
Sandstrom, C. J., 218.
Sanford, G. B., 537.
Sano, Z., 684.
Sansome, F. W., 121.
Sanz, B., 379.
Sapehin, A. A., 325.
Sargent, H. O., 190.
Sargent, R. O., 277.
Sarvis, J. T., 253.
Sasaki, S., 24.
Sasano, K. T., 871.
Sato, M., 665.
Sato, S., 772.
Satterthwait, A. F., 759.
Saunders, A. R., 34.
Saunders, C. G., 662.
Saunderson, M. H., 583.
Sauve, E. C., 676.
Savage, J. R., 456.
Sayre, C. B., 635.
Sayre, J. D., 215, 235.
Sayre, M. F., 76.
Scales, F. M., 259.
Scaramuzzi, D., 26.
Scarseth, G. D., 209, 210.
Scarth, G. W., 213.
Schaaf, J., 869.
Schaars, M. A., 482.
Schacht, F. L., 259.
Schaffer, J. M., 671.
Schaffner, J. H., 338.
Schalk, A. F., 267, 271.
Schander, 535.
Schantz-Hansen, T., 837.
Scheer, E., 870.
Scheffer, T. H., 49.
Scheicher, O., 869.
Scheimpflug, W., 398.
Scheinoff, M. J., 870.
Schelling, V., 95.
Scheltema, A. M. P. A., 628.
Schenk, R., 869.
Schermer, S., 567.
Schermerhorn, L. G., 830.
Schertz, F. M., 25, 216.
Schewket, N., 247.
Schieblich, M., 496.
Schilling, G. S., 671.
Schilling, S. J., 471.
Schilling, W. F., 580.
Schimitschek, E., 852.
Schindler, A., 80, 387.
Schiøler, E. L., 545.
Schlenker, F. S., 816.
Schlieter, H., 870.
Schmidt, C. L. A., 9, 10.
Schmidt, R., 136, 137.
Schmidt, S., 78.
Schmidt-Hoensdorf, F., 567, 870.
Schmitt, J., 870.
Schneider, L. R., 618.
Schneider, P. F., 428.
Schnetzler, E. E., 798.
Schoene, W. J., 54.
Schoenfeld, W. A., 699.
Schoening, H. W., 674.
Schollenberger, C. J., 504.
Scholz, K. W., 684.
Schoth, H. A., 37, 826.
Schott, R. G., 328.
Schouppe, K., 567.

Schrader, I. M., 492.
Schreiber, A. M., 892.
Schreiner, O., 628.
Schrero, M., 879.
Schrimpf, H., 567.
Schuette, H. A., 508.
Schüffner, W. A. P., 550.
Schulte, R. B., 88.
Schultz, E. S., 347, 749.
Schultz, O., 567, 870.
Schultz, W., 625.
Schuster, C. E., 740.
Schuurmans Stekhoven, J. H., jr., 546.
Schwantes, A. J., 275.
Schwarte, L. H., 572.
Schwartz, B., 72.
Schwartz, L. H., 798.
Schwarz, E., 626.
Schweers, M. F., 404.
Scofield, J. H., 90.
Scott, C. E., 446.
Scott, E., 666.
Scott, E. L., 64.
Scott, F. L. de N., 287.
Scott, H. T., 258, 462, 463, 470.
Scott, S. W., 411.
Scott, W. M., 471.
Scudder, H. D., 580, 885.
Seal, J. L., 437.
Sears, F. C., 340.
Seddon, H. R., 71, 568, 571.
Seedorf, J. J. W., 80.
Seekles, L., 472.
Seelemann, M., 868.
Seeley, D. A., 111.
Seidell, A., 109, 805.
Seifried, O., 264, 381, 869, 870.
Sein, F., jr., 50, 851.
Seitz, C. E., 404, 676.
Selezeneva, A. A., 557.
Sell, O. E., 462.
Selwyn, H. H., 33.
Semple, A. T., 761.
Sen, K. R., 825.
Sen, S. K., 656, 673.
Sendroy, J., jr., 206.
Senn, P. H., 819.
Serebrovsky, A. S., 425.
Sergent, E., 776.
Sering, M., 78, 387.
Severin, H. H. P., 753.
Sewell, M. C., 798.
Sewell, W. E., 460.
Seymour, A. C., 700.
Shamel, A. D., 640.
Shands, R. G., 441.
Sharp, P. F., 374.
Shattuck, G. C., 791.
Shaw, F. J. F., 817.
Shaw, H. B., 530.
Shaw, J. K., 339, 340, 637.
Shaw, J. N., 72, 672.
Shealy, A. L., 459.
Shear, M. J., 893.
Sheard, C., 463.
Sheets, E. W., 255.
Sheets, O., 891.
Sheldon, W. H., 697.
Shelton, E. J., 662.
Shen, T. H., 628.
Shepard, H. H., 846.
Sherbakoff, C. D., 149, 537, 840.
Sherman, C. B., 400, 585.
Sherman, H. C., 11, 311, 390, 587.
Sherwood, F. W., 467.
Shimotomai, N., 500.
Shinn, E. H., 687.
Shippy, W. B., 48, 520.
Shirley, H. E., 556.
Shirley, H. L., 837.
Shive, J. W., 24.
Sholl, L. B., 70, 670.
Shope, R. E., 674, 872.
Shorey, E. C., 505.
Shrewsbury, C. L., 559.
Shriver, L. C., 629.
Shuck, A. L., 699.
Shull, A. F., 724.
Shull, C. A., 518.
Shull, W. E., 50.
Shuman, J. W., 618.
Shutt, F. T., 33, 799.
Shu-Yen, L., 547.
Sideris, C. P., 835.
Siegel, J., 893.
Siemsen, W. J., 694.
Sievers, F. J., 399.
Sikes, E. K., 244.
Silcox, W. B., 83.
Silva, A. Alves da, 655.
Silver, J., 151.
Silverhjelm, M., 286.
Simanton, F. L., 457.
Simmons, J. S., 550.
Simmons, P., 357.
Simms, B. T., 72, 671, 672.
Simonnet, H., 804.
Simpson, F. M., 585.
Simpson, G. W., 200.
Simpson, H. D., 388.
Simpson, S. L., 471.
Sinclair, J. M., 870.
Singh, B., 669.
Singleton, R. E., 487.
Sinitsin, D. F., 752.
Sinnott, E. W., 624.
Sipe, G. R., 65.
Sjögren, B., 608.
Sjollema, B., 472.
Skeete, C. C., 446.
Skinner, J. H., 198.
Skinner, J. J., 22, 631.
Skinner, J. T., 12, 490, 491.
Skinner, M. L., 890.
Skinner, W. E., 277.
Skrkanek, G., 568.
Slagg, C. M., 46.
Slate, W. L., 400, 797.
Slater, C. S., 19.
Slaughter, I. S., 329.
Sleesman, J. P., 247.
Sleightholme, J. J. 666.
Sloan, H. J., 255, 556.
Slobin, H. L., 846.
Slonaker, J. R., 790.
Smallfield, H. A., 69, 488.
Smart, B. W., 203.
Smirnov, A. I., 214, 216.
Smith, A. D. B., 554.
Smith, A. H., 794, 897.
Smith, B. T., 189.
Smith, C. B., 580, 585, 686, 889.
Smith, C. L., 900.
Smith, C. R., 547.
Smith, D. D., 676.
Smith, E. A., 289.
Smith, E. C., 669.
Smith, E. H. G., 528.
Smith, E. L., 501.
Smith, F. B., 20, 419.
Smith, F. F., 249, 455.
Smith, H., 498.
Smith, H. B., 425.
Smith, H. C., 254.
Smith, H. H., 895.
Smith, H. P., 275, 676.
Smith, H. S., 156, 549, 753, 856.
Smith, H. V., 596.
Smith, J., 568.
Smith, J. B., 514.
Smith, J. O., 187.
Smith, K. M., 545, 652.
Smith, L., 200.
Smith, L. H., 117, 811.
Smith, L. M., 52, 753, 754.
Smith, M. C., 363, 596.
Smith, M. E., 494, 793.
Smith, M. I., 109, 806.
Smith, M. R., 58.
Smith, O., 738.
Smith, P. E., 695.
Smith, P. H., 60.
Smith, R. E., 351.
Smith, R. H., 549.
Smith, R. S., 117, 811.
Smith, R. W., jr., 865.
Smith, S. L., 587, 889.
Smith, T. L., 498.
Smith, V. D. E., 792.
Smith, W. K., 880.
Smith, W. W., 586.
Smits, M. B., 628.
Smythe, C. V., 10.
Snapp, O. I., 50, 453, 851.
Snell, M. E., 337, 338.
Snell, M. G., 498.
Snijders, E. P., 550.
Snyder, E. B., 898.
Snyder, H. C., 618.
Snyder, T. E., 546, 756.
Sommer, A. L., 516.
Sommer, H. H., 468, 469, 665.
Sondergaard, H. T., 482.

Sorber, D. G., 509.
Sordelli, A., 878.
Sorokin, P. A., 687.
Souček, J., 530.
Soule, A. M., 888.
Southgate, B. A., 65.
Spahr, W. E., 487.
Spencer, D. A., 254.
Spencer, G. J., 355.
Spencer, L., 483.
Spencer, V. E., 720.
Spéville, J. D. de, 531.
Speyer, E. R., 361.
Spiker, C. J., 545.
Spillman, W. J., 80, 601, 604, 605, 607.
Spinks, G. T., 638, 640.
Sponsler, O. L., 215.
Sprague, H. B., 24, 31, 813, 824.
Sprake, C. H., 675.
Spuler, A., 154, 652.
Spurway, C. H., 504.
Stadie, W. C., 206.
Stadler, L. J., 332.
Stádník, J., 198.
Stafford, E. S., 30.
Stafseth, H. J., 176, 270, 473, 875.
Staig, R. A., 353.
Stakman, E. C., 442.
Stammer, H.-J., 360.
Staniland, L. N., 653.
Stanley, E. B., 60, 300.
Stanley, J., 626, 835.
Stanley, L., 889.
Stanley, W. W., 253.
Stansfield, R., 675.
Stanton, T. R., 132.
Stapleton, H. N., 404.
Starcher, G. R., 478.
Stark, R. W., 732.
Starker, T. J., 342.
Starkey, R. L., 321.
Stauber, B. R., 82.
Stearn, A. E., 202.
Stearns, H. T., 575.
Stedman, T. L., 566.
Steece, H. M., 796.
Steenbock, H., 372, 398, 459, 490, 491, 492.
Steer, H. B., 43.
Steggerda, M., 220, 524.
Stein, H. B., 96.
Steiner, P., 852.
Stekhoven, J. H. S., jr., 546.
Stemmons, W., 888.
Stenström, B., 870.
Stephens, J. C., 631.
Stephens, J. L., 87.
Stephens, P. H., 579.
Stephenson, R. S., 254.
Sterges, A. J., 813.
Stevens, N. E., 49.
Stevens, O. A., 133, 338.
Stevens, W. H. S., 683.
Stevens, W. R., 714.
Stevenson, T., 531.
Stevenson, W. H., 17, 21, 198, 620.
Stewart, C. L., 79.
Stewart, G., 117, 207, 222, 226, 299, 325, 432, 627, 724, 843.
Stewart, P. H., 320.
Stewart, R., 720.
Stewart, R. E., 87.
Stewart, W. L., 268.
Stiebeling, H. K., 192.
Stieger, G., 296.
Stiles, C. W., 650.
Stiles, G. W., jr., 178.
Stine, O. C., 307, 579, 585.
Stirniman, E. J., 281, 578, 777.
Stitt, R. E., 330.
Stoa, T. E., 39.
Stockdale, F. A., 628.
Stockwell, C. W., 57.
Stoddard, H. L., 544, 545.
Stöhr, 399.
Stoker, H. M., 80.
Stokes, W. E., 225, 429.
Stoklasa, J., 119.
Stone, A. A., 274.
Stone, A. L., 432.
Stone, J. C., 482, 585.
Stone, V., 500.
Stoneman, J. A., 385.
Stoner, D., 53.
Storey, H. H., 443.
Stouder, K. W., 56.
Stout, W. B., 798.
Stover, H. J., 80, 886.
Stover, W. G., 648.
Stoyle, J. A. R., 566.
Straight, E. M., 60.
Strange, C. R., 470.
Straszheim, R. E., 385, 481.
Stratton, H. J., 389.
Strauch, T. J., 866.
Street, O. E., 334, 336.
Streeter, L. R., 52.
Streets, R. B., 300.
Streiff, A., 317.
Strong, F. C., 150.
Strong, L. C., 217.
Strong, W. J., 40.
Strouse, S., 895.
Strubelt, 568.
Stuart, H. O., 64, 700.
Stuart, L. S., 629.
Stuart, W., 827.
Stubbs, E. L., 270, 381.
Stubbs, F. H., 392.
Stuckey, H. P., 197, 899.
Studensky, G. A., 276.
Stuhr, L., 580.
Stunkard, H. W., 353.
Sturdee, E. L., 471.
Sturkie, D. G., 331, 428.
Sturlaugson, V., 39.
Sturrock, D., 531.
Sturtevant, C. D., 683.
Suhr, R., 870.
Sulerud, G. L., 282.
Summers, T. H., 386.
Sumner, J. B., 12.
Sundararaman, S., 241.
Sunderlin, G. L., 488, 498.
Sunderman, F. W., 206.
Supplee, G. C., 263.
Supplee, W. C., 900.
Sure, B., 494, 495, 793.
Sutton, T. S., 663, 699.
Svedberg, T., 608.
Swales, B. H., 545.
Swanback, T. R., 334.
Swanson, H. B., 190.
Swarbrick, T., 637, 638.
Swart, J. C., 62.
Swartwout, H. G., 340.
Swartz, VeN. W., 287, 697.
Sweeney, M. P., 699.
Sweeney, O. R., 403.
Sweet, A. T., 117, 208.
Sweet, C. V., 142.
Sweetman, H. L., 253.
Sweetman, M. D., 86.
Swenson, R. J., 487.
Swinson, C. R., 189.
Szalay, A. B., 522.

Takahashi, M., 730, 737.
Takahashi, R., 248.
Takamiya, E., 205.
Talbert, T. J., 340.
Talman, C. F., 413.
Tammes, T., 325.
Tatarinova, N. V., 555.
Taubenhaus, J. J., 841.
Taylor, A. E., 582, 684.
Taylor, C. B., 528.
Taylor, H. C., 79, 678, 686.
Taylor, J. W., 33, 214.
Taylor, R. W., 428, 434, 835.
Teller, L. W., 478.
Tempany, H., 530.
Temperley, M. E., 248.
Templeton, H. L., 469.
Tenny, L. S., 80, 585, 683.
Teodoro, A. L., 879.
Teorell, T., 313, 710, 806.
Terao, H., 530, 628.
Terrill, J. N., 508.
Terris, E., 772.
Terry, E. G., 657.
Teruuchi, Y., 894.
Tetreau, E. D., 391.
Thatcher, H. S., 494, 495.
Thayer, S. A., 30.
Theodor, O., 361.
Thiessen, E. J., 787.
Thigpen, J. E., 799.
Thom, C., 566.
Thomas, C. A., 551.
Thomas, E. F., 475.
Thomas, I., 250.
Thomas, M. E., 165.
Thomas, P. H., 838.

Thomas, R. C., 235.
Thomas, R. P., 333.
Thomas, W., 302.
Thomashoff, E., 868.
Thompson, A., 804.
Thompson, C. H., 798.
Thompson, C. P., 256.
Thompson, D., 543.
Thompson, D. H., 324.
Thompson, H. C., 635, 828.
Thompson, I. D., 470.
Thompson, J. B., 729, 737, 797.
Thompson, L. G., jr., 419.
Thompson, L. S., 545.
Thompson, R. B., 662.
Thompson, R. R., 672.
Thompson, S. H., 888.
Thompson, W. C., 368, 578.
Thompson, W. O., 497, 888.
Thomsen, A., 569.
Thomsen, F. L., 387, 485, 585.
Thomson, A., 15.
Thomson, D., 266.
Thomson, J. R., 50, 453, 851.
Thomson, L. R., 285.
Thomson, R., 266.
Thornberry, H. H., 750.
Thorne, C. E., 302.
Thornton, N. C., 412.
Thornton, S. F., 19.
Thornwaldson, M. L., 768.
Thornycroft, O., 675.
Thorp, F., jr., 573.
Thorp, J., 16.
Thorpe, W. H., 251.
Thrun, F. M., 82.
Thurston, F. M., 889.
Tiedeman, W. D., 865.
Tiedjens, V. A., 340.
Tieu, N. C., 628, 756.
Tilden, E. B., 92.
Tilley, F. W., 671.
Tillyard, R. J., 353.
Tilt, J., 288.
Timon-David, J., 253.
Timoshenko, V. P., 580.
Tischler, N., 453.
Tisdale, H. B., 428.
Tisdale, W. B., 429.
Tittsler, R. P., 382.
Tobiska, J. W., 897.
Tojo, K., 628.
Tollenaar, D., 648.
Tolles, G. S., 854.
Tolley, H. R., 276, 580, 888.
Tolstuchina, E. N., 871.
Tomhave, A. E., 763.
Tomkins, R. G., 232.
Tomsa, K., 237.
Torres, D. D. de, 651.
Torrey, J. P., 70, 175.
Tory, H. M., 307, 483.
Tottingham, W. E., 422.
Towle, R. S., 731.
Townsend, C. H., 352.
Toy, L. R., 232.
Tracy, P. H., 68, 867.
Traumal, H., 469.
Traub, H. P., 835, 843.
Traum, J., 570, 770.
Traupe, R., 567.
Trautwein, K., 868, 869.
Trawiński, A., 870.
Trayer, G. W., 881.
Tretsven, J. O., 561.
Trillat, A., 876.
Trinkle, E. L., 499.
Troisier, J., 871.
Troitzky, N. N., 852.
Trout, G. M., 664.
Trout, S. A., 232.
Trowbridge, E. A., 255.
Truax, T. R., 780.
Trueman, H. L., 889.
Trullinger, R. W., 1, 402, 574, 889.
Trumble, H. C., 529.
Truog, E., 302.
Tscherniak, W. S., 567.
Tuason, A., 64.
Tubangui, M. A., 266, 570.
Tucker, C. M., 841.
Tucker, H. H., 498.
Tucker, L. O., 768.
Tucker, M. L., 799.
Tucker, R., 698.
Tufts, W. P., 736.
Turner, A. J., 224.
Turner, C. W., 254, 329.
Turner, J., 100.
Turner, L. M., 900.
Turner, M. E., 90.
Turner, S. E., 535.
Turpin, T., 757.
Tussing, E. B., 826.
Tutin, F., 653.
Twinn, C. R., 250, 656.
Tyler, J., 754.
Tyrrell, W. A., 223.
Tysdal, H. M., 148.
Tzouliadis, P., 581.

Überreiter, O., 567.
Udall, D. H., 70, 670.
Uichanco, L. B., 756.
Ulbrich, J., 242.
Ulrich, H., 869.
Underhill, F. A., 894.
Underwood, P. C., 874.
Underwood, W. W., 798.
Upp, C. W., 498.
Urbain, O. M., 411.
Ursprung, A., 119.
Uvarov, B. P., 845, 851.

Vahlteich, E. McC., 290.
Vaiden, M. G., 187.
Vail, C. E., 897.
Vaile, J. E., 486.
Valerio, B. G., 271.
Valleau, W. D., 47, 239.
Vallée, M., 872.
van Beynum, J., 867.
Vance, A. M., 252.
van der Goot, P., 656, 756.
van der Kaay, F. C., 472, 567.
van der Merwe, C. R., 533.
van der Poel, J., 531.
van der Vecht, J., 651.
Van Derwerker, R., 656.
Van Diermen, 868.
van Dijk, J., 531.
Van Es, L., 267.
Van Lone, E. E., 425.
Vannote, R. L., 656.
Van Orman, W. T., 317.
Van Roekel, H., 375, 776.
Vansell, G. H., 755.
Van Slyke, L. L., 799.
Van Stolk, D., 804.
van Veen, A. G., 311.
van Zwaluwenburg, R. H., 356.
Vasey, A. J., 646.
Vass, A. F., 80, 580.
Vaughan, H. W., 60.
Vavilov, N. I., 79.
Vawter, L. R., 668, 775, 870.
Veatch, J. O., 678, 740.
Vecht, J. van der, 651.
Veen, A. G. van, 311.
Veenendaal, H., 869, 870.
Venkatraman, T. S., 531.
Verge, J., 872.
Vernon, J. J., 189, 483.
Verret, J. A., 531.
Vesper, F. W. A., 698.
Vickery, H. B., 9, 36.
Viemont, B. M., 696.
Vilbrandt, F. C., 528.
Vincent, C. C., 228.
Vincent, G. E., 499.
Vine, B. de, 662.
Vinson, C. G., 843.
Vittorini, D., 684.
Vlasov, A. I., 372.
Voegtlin, C., 201.
Volin, L., 276.
Völker, R., 869, 870.
Volkmar, F., 472.
Vollmer, H., 296.
Voorhies, E. C., 256.
Vouk, T. V., 120.
Voukassovitch, H., 549, 552.
Voukassovitch, P., 549, 552.
Voûte, A. D., 60.
Vuyst, P. de, 287.

Wachenfelt, M. de, 662.
Wada, C., 894.
Waddell, J., 459.
Wadsworth, H. A., 716.
Wagener, K., 869.
Waggoner, C. S., 92.
Waid, C. W., 585.
Wait, B. C., 798.

Waite, R. H., 861.
Wakefield, E. M., 444.
Wakeland, C., 50.
Wakeley, P. C., 233.
Wakeley, R. E., 786.
Waksman, S. A., 302, 321.
Walden, B. H., 451.
Walker, A. L., 187.
Walker, C. E., 278.
Walker, D. J., 494, 495, 793.
Walker, F. W., 452.
Walker, H. B., 404, 777.
Walker, J. C., 237, 441, 442, 446.
Walker, L. S., 516, 553.
Walker, M. N., 237, 843.
Walker, R. H., 619.
Wall, J. F., 556.
Wall, R. E., 546.
Wallace, B. A., 386.
Wallace, B. B., 386.
Wallace, F. G., 73.
Wallace, H. F., 31, 39, 99.
Wallace, L. W., 404, 888.
Wallace, Q. W., 159, 661.
Wallace, T., 638, 896.
Waller, A. G., 882.
Walsh, W. F., 323
Walton, C. L., 653.
Wan, S., 691, 692.
Wander, H., 869.
Wang, C. C., 695.
Warburton, C. W., 888.
Ward, A. R., 865.
Ward, C. B., 568.
Ward, R. DeC., 315.
Ware, W. M., 539.
Waring, J. H., 639.
Waring, W. G., 303.
Warner, H. W., 517.
Warner, K. F., 364, 689.
Warner, P. E., 286.
Warren, D. C., 254, 328.
Warren, G. F., 78, 276, 581, 582.
Warren, G. M., 74.
Warwick, B. L., 254, 820.
Watanabe, M., 568.
Watchorn, E., 95.
Watenpaugh, H. N., 118, 798.
Waters, N. F., 820.
Watkins, W. E., 760.
Watkins, W. I., 575.
Watson, J. R., 451.
Watson, K. M., 309.
Watson, P. D., 564.
Watt, A. L., 78.
Watt, M. R., 286.
Watts, R. L., 303, 499.
Waugh, F. A., 436.
Waugh, F. V., 80.
Way, C., 70.
Weatherwax, P., 624.
Weaver, F. P., 79, 189, 277, 783, 883.
Weaver, H. J., 382.
Weaver, J. E., 215.
Weaver, W., 520.
Webber, R. T., 656.
Weber, A. D., 498, 660, 859.
Weber, C. J., 12.
Weber, G. F., 45, 843.
Webster, C. B., 233.
Webster, R. L., 854.
Weckel, K. G., 468.
Weddell, J. A., 248.
Wedemann, W., 868.
Weeks, D., 580.
Wehrwein, C. F., 389, 390.
Wehrwein, G. S., 79, 481. 580.
Weightman, R. H., 714.
Weihe, H. D., 409.
Weimer, J. L., 727.
Weinstock, M., 794.
Weis, I., 852.
Weisner, E. S., 473.
Weiss, F., 347.
Welborne, W. W., 31, 99.
Weldin, J. C., 382.
Welikanow, I. M., 871.
Weller, B., 266.
Wellington, J. W., 701.
Wellington, R., 342.
Wellman, F. L., 236, 237.
Wellman, H. R., 189.
Wells, C. F., 783.
Wells, F. G., 879.
Wells, O. V., 187.
Welsh, W. E., 70, 471.
Welton, F. A., 35, 129, 822.
Went, S., 803.
Werner, H. O., 827.
Wertjatschkin, N. Q., 868.
Wessels, P. H., 635, 828.
West, C., 895.
Wester, P. J., 800.
Westerdijk, J., 352.
Western, G. T., 471.
Westfall, B. B., 615.
Westgate, J. M., 730, 737, 797.
Westgate, W. A., 846.
Weston, W. A. R. D., 444, 648.
Westover, K. C., 633, 827.
Westveld, M., 141.
Westveld, R. H., 437.
Wetmore, A., 545.
Whalen, F. B., 295.
Wharton, M. F., 300.
Wheeler, E. J., 633.
Wheeler, K. M., 510.
Wheeler, S. S., 166, 300.
Wheeler, T., 395.
Wheeting, L. C., 499.
Whelpton, P. K., 687.
Whetham, W. C. D. D., 581, 880.
Whitaker, R., 173, 689.
Whitaker, T. W., 120.
Whitcomb, W. D., 354.
Whitcraft, A. R., 847.
White, C. M., 86.
White, E. A., 403.
White, H. A., 188, 583.
White, H. B., 698.
White, H. E., 339.
White, J. W., 302.
White, P. B., 377.
White, R. P., 352, 539, 841.
White, W. E., 436.
White, W. N., 574.
Whiteman, T. M., 827, 891.
Whitfield, F. G. S., 246.
Whitney, M., 406.
Whitsitt, M. L., 311, 612.
Whittaker, E., 79.
Whittemore, M., 91.
Whittier, E. O., 411, 566.
Wiant, D. E., 76.
Wiant, J. S., 747.
Wiecking, E. H., 80, 82.
Wiegand, E. H., 616, 788.
Wigglesworth, V. B., 244.
Wight, A. E., 267.
Wilbur, R. L., 888.
Wilbur, W. E., 846.
Wilcox, F. R., 580.
Wilcoxon, F., 357.
Wilde, E. I., 641.
Wilder, W., 397.
Wildermuth, R., 16.
Wildermuth, V .L., 552.
Wildman, J. D., 11.
Wiles, D. R. D., 441.
Wiley, C. A., 680.
Wilford, E. J., 255.
Wilgus, H. S., jr., 556, 557, 559.
Wilkie, J .B., 598.
Wilkinson, P. D., 395.
Willaman, J. J., 635, 712.
Willard, A. C., 297.
Willard, H. F., 756.
Willard, H. S., 171, 766.
Willard, R. E., 799.
Willcox, O. W., 526.
Willett, H. C., 714, 808.
Willham, O. S., 362, 464.
Williams, A. P., 190.
Williams, B. H., 117.
Williams, C. B., 114, 118, 126, 131, 758.
Williams, C. F., 136.
Williams, C .G., 409.
Williams, D. W., 255.
Williams, G. Z., 94.
Williams, O. E., 263.
Williams, R., 537.
Williams, R. C., jr., 655.
Williams, R. S., 377.
Williams, W. W., 378.
Williamson, J. T., 428.
Willis, E. A., 779.
Willis, L. G., 323.
Willis, R. L., 40.
Willis, T. F., 478.
Wills, L., 297.
Wilmot, R. J., 454.

Wilson, A. L., 52.
Wilson, C. A., 683.
Wilson, C. P., 32.
Wilson, C. V., 253, 364.
Wilson, D. C., 398.
Wilson, E. E., 445, 541.
Wilson, G. F., 246.
Wilson, G. S., 375.
Wilson, H. F., 856.
Wilson, H. K., 768.
Wilson, I. D., 774.
Wilson, J. D., 822.
Wilson, J. F., 254.
Wilson, J. J., 149.
Wilson, J. W., 452.
Wilson, L., 117.
Wilson, M., 751.
Wilson, P. W., 422, 711.
Wiltshire, S. P., 809.
Wimer, D. C., 312.
Windaus, A., 614.
Wingard, S. A., 47.
Winkler, A. J., 736.
Winkler, C. A., 394.
Winkler, W., 864.
Winter, O. B., 260.
Wintermyer, A. M., 779.
Winters, E., 312.
Winters, L. M., 254.
Winters, R. Y., 198.
Wirick, A. M., 595.
Wirka, R. M., 780.
Wishart, J., 221, 223.
Withrow, J. R., 808.
Withrow, L., 274.
Withycombe, R., 160, 659.
Witte, J., 773, 870.
Wlassoff, A. I., 372.
Wode, G., 867.
Wodsedalek, J. E., 217, 218.
Wolberg, F. B., 798.
Wolf, F. A., 536.
Wolfe, J. M., 28.
Womack, E. B., 28.
Woodbury, G. W., 641.
Woodger, J. H., 623.
Woodroof, J. G., 139.
Woodroof, N. C., 45.
Woodruff, A. M., 876.
Woodruff, C. E., 270.
Woodward, C. R., 586.
Woodward, R. W., 325.
Woodward, T. E., 663.
Woodworth, C. M., 521.
Woofter, T. J., jr., 886.
Work, A., 477.
Working, E. B., 698, 798.
Working, E. J., 80.
Working, H., 80, 281.
Wormald, H., 540.
Worthley, L. H., 457.
Wriedt, C., 27, 327.
Wright, F. B., 575.
Wright, K. E., 263, 371, 799.
Wright, L. I., 219.
Wright, N. C., 71.
Wright, R. C., 827, 891.
Wright, S., 324.
Wright, W. H., 72, 874.
Wu, C. F., 546.
Wu, H., 691.
Wulff, A., 628.
Wyllie, J., 385, 581.
Wyman, A. F., 686.
Wyman, J., jr., 608.
Wymore, F. H., 754.

Yakimoff, W. L., 777, 870.
Yale, M. W., 699.
Yamagiwa, S., 568.
Yen, L. S., —, 547.
Yetter, W. P., jr., 249.
Yochem, D. E., 426.
Young, A., 761.
Young, H. C., 537.
Young, L. J., 342.
Young, R. E., 799.
Young, S. P., 242, 845.
Young, W., 566.
Young, W. C., 218.
Youngberg, S., 644.
Youngblood, B., 580.
Youngman, W., 520.
Yutuc, L. M., 570.

Zacher, F., 551.
Zakowski, J., 712.
Zail, C., 293.
Zappe, M. P., 451.
Zbinden, C., 292.
Zeissler, J., 870.
Zeleny, L., 609.
Zeller, J. H., 555.
Zernoff, V., 550.
Zilva, S. S., 503, 895, 896.
Zimmerman, C. C., 86, 687.
Zimmerman, P. W., 518.
Zimmerman, S. K., 758.
Zinsser, H., 870.
Zobell, C. E., 569.
Zobell, I. D., 207, 222, 299.
Zon, R., 644.
Zook, G. F., 888.
Zühdi, M., 869.
Zunker, M., 869.
Zwaluwenburg, R. H. van, 356.
Zweigbaumówna, Z., 442.
Zweigelt, F., 548.
Zwick, W., 773, 870.
Zwölfer, W., 852.

INDEX OF SUBJECTS

NOTE.—The abbreviations "Ala.," "Conn.State," "Mass.," etc., after entries refer to the publications of the respective State experiment stations; "Alaska." "Guam," "Hawaii," "P.R.," and "V.I." to those of the experiment stations in Alaska, Guam, Hawaii, Porto Rico, and Virgin Islands; "Can." to those of the experiment stations in Canada; and "U.S.D.A." to those of this Department.

Abortion—*see also Bacterium abortus and Brucella abortus.*
- and *Brucella suis* infection in a sow, Mich. 670.
- antibody titer curves in, Ind. 174.
- control, 70.
- control and eradication, Utah 670.
- control with organic iodine, N.J. 872.
- diagnosis, test tube agglutination test for, Minn. 177.
- diseased herd, breeding record, Mich. 771.
- in cattle, Conn.Storrs 775; Wis. 470.
- in cattle, economic factors, 268.
- in cows on different rations, 70.
- in mares, vaccination experiments, 670.
- in monkeys, Mich. 771.
- in range cattle, Wyo. 176.
- in sheep, cause, 377.
- organism of cattle, immunity of human beings to, Mich. 772.
- organism, tissue reaction to, Mich. 771.
- research by Bureau of Animal Industry, 265.
- vaccination with an avirulent culture, Mich. 771.
- vaccines, commercial, viability and virulency, Mich. 175.

Absidia in soil flora, 320.

Acacia arabica, notes, 246.

Accessory food factors, *see* Vitamins.

Accounting, farm, *see* Farm accounting.

Acetaldehyde, use in fruit storage, 232.

Acetic acid, dissociation constants, evaluation, 611.

Acetone in blood of pregnant and non-pregnant cows, 567.

Achorutes manubrialis in cold frames, Conn.State 451.

Acid phosphate, *see* Superphosphate.

Acids—
- amino, *see* Amino acids.
- fatty, *see* Fatty acids.
- in salt solutions, thermodynamic properties, 611.
- organic, in honey, 408.
- organic, in tobacco leaves, Conn.State

Acridine derivative, action on *Bacillus abortus*, 869.

Acrobasis juglandis, notes, Fla. 452.

Acrolophus sp., damage to corn, Iowa 153.

Acrydium arenosum, inheritance of color patterns in, 217.

Actinomyces—
- *necrophorus*, notes, 572.
- *scabies*, notes, 345; N.J. 838.
- sp., notes, 749.

Adelges abietis—
- as nursery pest, 455.
- control, N.Y.Cornell 53.

Adenoma, intestinal, of swine, 572.

Adobe construction, studies, Calif. 777.

Adrenaline, action on bovine uterus, 868, 869.

Aedes—
- *aegypti*, *see* Yellow fever mosquito.
- *sylvestris*, egg-laying habits, N.J. 847.

Aegeria rutilans, see Strawberry crown moth.

Aegyptianella pullorum—*see also Egyptianella pullorum.*
- in fowls in Algeria, 877.
- latent, effect of splenectomy, 674.

Aerial wires, humming and atmospheric disturbances, 111.

Aerology, *see* Air.

Aeronautics, status of instruction in, 889.

Agglutination test, use in phytobacteriology, 746.

Agglutinins—
- in blood produced by bacteria in respiratory tract of fowls, 270.
- production by phytopathogenic bacteria, 840.

Agrarian reform—
- in central and eastern European countries, 582, 583.
- in Central Europe, needed improvement, 581.
- in Greece, 581.

Agricultural—
- adjustments, integration of research and extension for, 580.
- areas, submarginal, program for, 580.
- business of world, maladjustments, 78.

Agricultural—Continued.
colleges—*see also* Iowa, Kansas, Massachusetts, *etc.*
and farmer, 888.
and universities, contributions to social and economic progress, 888.
organization list, U.S.D.A. 190.
colonization, *see* Land settlement.
commodities, gross income from, Iowa 185.
commodities, marketing, auction-block systems, 585.
cooperation in Italy, 685.
cost studies, perspectives on value, 580.
credit—
in China, 80.
in Germany, 583.
in Kentucky, Ky. 185.
in Southwest, research problems, 278.
in United States, 682.
international, documentation relative to, 583.
problems in United States, 80.
problems of cotton farmers, Okla. 278.
depression—
and technical revolution in farming, 276.
causes, 581.
causes and probable duration, 78.
in Great Britain, 78.
in Poland, 78.
middlemen's margins as cause, 276.
middlemen's margins as cause, criticism, 886.
development, state program, 276.
economic extension work, developments in, 580.
economics—*see also Rural economics.*
as applied economics, 79.
budgeting method of planning, 579.
charts, U.S.D.A. 80.
Danish problems in, 79.
development in Russia, 80.
outlines, textbook, 678.
Research Institute, Oxford, 581.
research methods, 581.
research program, 580.
Society of Great Britain, papers, 580.
economists, international conference of, proceedings, 78.
education—*see also* Agricultural colleges.
and research, pioneers in, passing of, editorial, 101, 102, 107.
in Ontario, history, 89.
organization in Germany, 89.
engineering, *see* Engineering.
experiment stations, *see* Experiment stations.
Agricultural—Continued.
extension, *see* Extension.
institutions, survey, results, 888.
journals, new, 500.
labor—*see also* Labor.
efficiency on German farms, 80.
in Germany, 580.
wages, index numbers, Ohio 481, 678.
laborers, organization, 79.
Libraries Section of American Library Association, meeting, 400.
Loan Association, South Carolina, analysis, U.S.D.A. 682.
machinery—*see also* Combines, Harvester, *etc.*
costs, computing, Mich. 676.
design and development, effect of irrigation and drainage, 575.
for beet production, developing, 275.
for harvesting and planting oats, Ala. 476.
for harvesting corn, experiments, 76.
handbook, 879.
in Canada and United States, 384.
research work in England, 482.
Testing Committee, report, 880.
Marketing Act, effect on Western States, 580.
Marketing Act, Federal, policies and plans under, 580.
outlook for 1931, U.S.D.A. 81.
outlook work, local and national, research in, 580.
output, restriction of, social implications, 580.
policy for United States, doctrines relating to, 79.
policy of Soviet Russia, 580.
possibilities in Russia, 79.
problem of United States, economist's approach, 79.
production—
adjustment in, 579.
effect of yield on costs and income, Mo. 385.
in Mexico, new forms, 79.
regulation, 580.
products—
best for export, 579.
certification, Federal standards, 80.
cooperative sale, 581.
cost of production—*see also specific crops.*
in England, 385.
gross cash income from Ohio farms, 385.
increasing returns, methods, 387.
index numbers, Ohio 481, 678.
local market requirements in Aroostook County, Me. 189.
marketing, *see* Marketing.
movement to terminal markets factors affecting, 80.

Agricultural—Continued.
products—continued.
perishables and semiperishables, future trading in, 585.
prices, index numbers, 279.
quality and price, relation, 80.
variations in local prices, Mo. 485.
records, statistical analysis, unification of methods, 579.
research in Scotland, summary, 598.
science, pioneers in, passing of, 601.
shows in Australia, 662.
situation, adjustment, state programs in, 79.
situation in Germany, 78.
situation in 1929–30, 681.
statistics, U.S.D.A. 486.
statistics as basis for agricultural economic studies, 79.
statistics of California, index to State sources, U.S.D.A. 584.
surpluses in United States, problem, 78.
Agriculture—
American, economic readjustments, papers on, 888.
and business, post-war interrelations, 79.
and the business cycle since 1920, 680.
and transportation, changes in, 883.
coincidence as major factor in, 821.
Department of, *see* United States Department of Agriculture.
electricity in, *see* Electricity.
extensive margin in, local definition, 79.
in California, economic problems, Calif. 81.
in Chicago region, 883.
in New Jersey, 586.
in nontropical countries, international prices and conditions, 387.
in Philippines, economic problems, 80.
in Russia, socialization, 79.
in Soviet Union, reconstruction, 79.
in Union of South Africa, conditions affecting, 388.
in United States, economic outlook, 581.
international depression, causes, 78.
International Institute of, administration and control, 79.
new improvements in, encouraging, 581.
1930 census, new features and uses, 580.
policies in United States affecting, 79.
public and nonofficial organization, 89.
public finance in, research work, 388.
socialist reconstruction, science and technic, 79.
specialization in, and Soviet State farms, 80.
relation to business activity, 276.
technical, and fundamental science, correlation, 888.
Agrilus anxius infestation, relation to lowered tree vitality, 454.
Agrobiology defined, 526.
Agromyzid flies of native pulses in Java, 656.
Agronomic research in Czechoslovakia, institutions for, 198.
Agropyron repens as host for Hessian fly, 457.
Agrotis ypsilon, *see* Cutworm, black.
Air—
drainage and formation of frost, 808.
in butter, 263.
realm of, treatise, 413.
Alabama College, notes, 199.
Alabama Station, notes, 100, 199.
Alabama Station, report, 496.
Alaska Stations, notes, 199.
Albumin, egg—
and salts of calcium and of potassium, equilibria between, 710.
diets rich in, effects, 489.
dry matter in different layers, 259.
pH stability region of, 608.
vitamin B_2 in, 591.
Alcohol, triatomic, from urine of pregnant women, physiological properties, 30.
Aleyrodes vaporariorum, *see* White fly, greenhouse.
Alfalfa—
and bromegrass mixtures, yields, Mont. 528.
as source of vitamin A in sorghum-grain rations, 363.
bacteria, inhibition by soil bacteria, Wis. 422.
bacterial wilt, description, Wyo. 747.
beetle, notes, 651.
black spot, notes, 345.
culture experiments, Wyo. 127.
culture under dry farm conditions, Utah 627.
culture under irrigation, Mont. 527.
dry inoculants for, 33.
failures, cause, Ala. 455.
fertilizer experiments, Miss. 31; N. Mex. 221; Nebr. 822.
forage value, Utah 222.
forage yields, V.I. 730.
hay as sole ration for dairy cattle, Nev. 767.
hay, effect of chopping and grinding, Idaho 255.
hay, feeding value, Calif. 762.
hay, grinding for fattening cattle, Minn. 365.
hay, microbial heating, effect of salt, 629.
hay, quality, relation to curing, U.S.D.A. 129.
hay v. pea vine hay for cows, Wis. 466.
hopper, three-cornered, notes, Ala. 455.
improvement, N.J. 824.
in bacterial wilt sections, effect of cultivation, Iowa 125.
in rotation, effects, Colo. 717.

Alfalfa—Continued.
leaves as protein supplement, Mich. 765.
long v. cut, effect on steers, Wyo. 159.
molasses meal for fattening lambs, Nebr. 859.
mosaic disease, notes, Calif. 727.
old stands, fertilizer experiments, Mich. 719.
premature dying out, cause, Calif. 727.
relative susceptibility to wilt and cold, Nebr. 148.
rust, notes, 345.
seed production, Mich. 729; Utah 432.
seed production, chalcid control in, U.S.D.A. 552.
seeds, hard, studies, 39.
strains and seed sources for Michigan, Mich. 628.
v. rape pasture for pigs, Mich. 164.
varieties, behavior, N.J. 31.
variety tests, Mass. 330; Mich. 729; N.C. 126; N.J. 824; N.Mex. 221; Nebr. 822; Wyo. 127.
vitamin A in, effect of artificial drying, Ind. 158.
water requirements, 128.
weevil, notes, 651.
white spot, irrigation as cause, 44.
wilt, control, Nebr. 837.
yields on heavy soils, effect of fertilizers, Mich. 496.
Alkali—
action on cystine and cysteine, 108.
action on thiohydantoin derivatives of cystine and cysteine, 11.
reserve in blood of equines and bovines, 568.
soils, studies, Utah 207; Wyo. 118.
Allegheny metal, solubility in milk, Wis. 469.
Allorhina nitida, see June beetle, green.
Alloys, corrosion rate in vinegar, Calif. 709.
Almonds, fumigation, Calif. 709.
Alternaria—
dianthi, notes, Mass. 344.
longipedicellata, notes, 646.
spp. on aster seed, N.Y. State 741.
Altica torquata, notes, Me. 757.
Aluminum—
bronze, corrosion rate in vinegar, Calif. 709.
inhibitory effect on plant growth, 516.
solubility in milk, Wis. 469.
sulfate for chlorosis of fruit trees, N.Mex. 234.
Ambrosia trifida, chemical composition at various stages, 629.
American—
Dairy Science Association, proceedings, 259.
Dairy Science Association, western division, proceedings, 65, 566.
Economic Association meeting, 580.
American—Continued.
Farm Economic Association meeting, papers, 275, 579, 883.
Library Association, Agricultural Libraries Section, meeting, 400.
Society of Agricultural Engineers, quarter centennial, editorial, 401.
Society of Animal Production, proceedings, 253.
Amines, formation, 609.
Amino acids—
action of formaldehyde on, 609.
added to milk, effect on anemia, 597.
combination with iron, mode of, 10.
heats of ionization, 10.
of flesh, 310.
p-Aminophenylguanidine hydroiodide, studies, 203.
Ammonia—
adsorption by soils, estimating soil colloids by, 211.
free, from concentrated fertilizers, injury to plants, 323.
photosensitized oxidation, 418.
plant responses to, N.C. 114.
Ammonification of nitrogenous substances by pure cultures of microorganisms, 720.
Ammonium—
absorption by plants at different growth stages, 322.
malate as source of nitrogen for tubercle bacilli cultures, 773.
salts, photosensitized oxidation, 418.
sulfate, effect on asparagus, N.J. 831.
sulfate in soil, fixation, nitrification, and leaching, Hawaii.Pineapple Canners' 815.
sulfate, nitrification, factors affecting, 23.
Amphicoma vulpina, notes, Mass. 357.
Amylase, pancreatic, purification, 11.
Anaphoidea calendrae, notes, 759.
Anaplasma marginale, tick transmission experiments, 553.
Anaplasmosis in cattle, Calif. 770; Fla. 472; U.S.D.A. 178.
Anemia—
due to milk diet, effect of feeding amino acids, 597.
in children, iron and copper treatment, 690.
in pigs, Ind. 163.
in pigs, new methods of feeding copper for, Wis. 459.
in pigs, treatment, Ind. 174.
infectious, hematological studies, diagnostic importance, 567.
nutritional, inability of metals other than copper to supplement iron for, 894.
nutritional, rôle of manganese in, 297.
pernicious, of pregnancy, studies, 297.
pernicious, treatment with hog stomach preparations, 296.
secondary, in infants, treatment with copper and iron salts, Wis. 491.

Angiosperms, chromosome numbers in, 522.
Angoumois grain moth, hatching of eggs, 244.
Animal—
aggregations, treatise, 845.
breeding—*see also specific animals.*
by artificial insemination, 27.
for high prolificacy, 602.
in Germany and Austria, 254.
projects in Russia, 254.
chromosomes, *see* Chromosomes.
diseases—*see also specific diseases.*
general epidemiology, treatise, 566.
in Great Britain, 566.
in Nigeria, 264.
in Punjab, 375.
in Rhodesia, 568, 870.
in Tanganyika, 264.
infectious, resistance to, 870.
virus, neurotropic, pathology, 264.
fats, *see* Fats.
genetics, work of University of Edinburgh, 254.
husbandry at Canadian experimental stations, Can. 60.
husbandry instruction, improvement, 255.
husbandry, objectives of college instruction, 255.
materials, manganese determination in, 12.
nutrition studies, Ind. 158; N.C. 158.
nutrition, use of marine products in, 254.
physiology and genetics in Great Britain, 254.
Animals—*see also* Cattle, Livestock, Mammals, Sheep, *etc.*
domestic, coccidial parasites, 266.
domestic, toxicity of sodium fluosilicate for, 358, 669.
small, nonmetal cage for, 897.
starved, toxic substances in blood, 772.
venomous, and insects of medical importance, treatise, 244.
wild, of North America, 242.
wild, predatory, information for field men controlling, U.S.D.A. 242.
Anomala orientalis, distribution and abundance in New York, 57.
Anopheles—*see also* Malaria *and* Mosquitoes.
maculipennis, generations and biological phenomena, 758.
Anorexia—
in children, corrective diets for, 693.
relation to excessive milk feeding and gastric motility, 694.
Ant, imported into Florida, 58.
Anthelmintics—
for parasites of swine, Ga. 162.
tests, 874.
Anthocyanins—*see also* Pigments.
behavior at varying pH values, 519.
Anthonomus—
grandis, *see* Boll weevil.
quadrigibbus, *see* Apple curculio.
Anthonomus—Continued.
rubi in Sweden, 552.
signatus, *see* Strawberry weevil.
spp. on pears in Rhone Valley, 657.
Anthracnose, *see specific host plants.*
Anthrax vaccination with nonattenuated virus, 569.
Antimony trichloride reaction with cod-liver oil and unsaponifiable fraction, 501.
Antineuritic vitamin, *see* Vitman.
Antirachitic, *see* Rickets *and* Vitamin D.
Antirrhinum foot-rot and wilt, notes, 241.
Antiscorbutic vitamin, *see* Vitamin C.
Antixerophthalmic vitamin, *see* Vitamin A.
Ants—
attending scales, use of tanglefoot for, 60.
gray, control, Calif. 755.
relation to mealybug control, Calif. 156.
white, *see* Termites.
Anuraphis roseus, *see* Apple aphid, rosy.
Anuraphis tulipae, notes, 247.
Aorurus subcloatus n.sp., description, 361.
Apanteles thompsoni, parasite of European corn borer, U.S.D.A. 252.
Aphanomyces cochlioides n.sp. on sugar beets, 539.
Aphelenchus fragariae on strawberry, control, Fla. 439.
Aphidid galls, histogenetic and biological studies, 548.
Aphidius—
gomezi n.sp., notes, 651.
janinii n.sp., notes, 651.
spp., parasites of cabbage aphid, 359.
Aphids—
as vectors of breaking in tulips, 247.
European black, biology and classification, 851.
on alfalfa, tests of burners for control, Calif. 777.
on truck crops, studies, Va.Truck 156.
parasites of, 651.
transmission of beet mosaic by, Wash. Col. 348.
transmission of plant viruses by, 247.
woolly, effect of soil on root infestation, Tenn. 851.
Aphis—
brassicae, *see* Cabbage aphid.
forbesi, notes, Fla. 439.
gossypii, *see* Cotton aphid *and* Melon aphid.
persicae, *see* Peach aphid, green.
rumicis, insecticide efficiency for, 357.
rumicis, life history, habits and control, Va.Truck 156.
rumicis, toxicity of rotenone and nicotine to, 846.
spiraecola, notes, 51; Fla. 451.
Aphodius larvae in lawns, Conn.State 451.
Apiaries, inspection, Conn.State 451.
Apiaries, inspection in Pennsylvania, 862.
Apiculture, *see* Beekeeping.
Aplanobacter—
insidiosum, control, Nebr. 827.

Aplanobacter—Continued.
- *michiganense*, control, 446.
- *michiganense*, notes, Wis. 441.

Apotettix eurycephalus, parthenoproduced, chromosomes, 217.

Apparatus—
- for cooking food with electric current passing through it, Iowa 196.
- for determination of pH of biological solutions, Calif. 753.
- for determining height of trees, 342.
- for judging tenderness of canned foods, U.S.D.A. 190.
- for maintaining constant relative humidity, 323.
- for measuring wet hiding power of coatings, 76.
- for soil sampling, 811.
- for testing breaking strength of straw, 734.
- for testing relative humidity, 520.
- multiple-chamber respiration, for small animals, 98.

Appetite—
- depraved, in cattle, 267.
- loss of, *see* Anorexia.

Apple—
- and cedar rust galls, strains, Iowa 145.
- aphid, green, overwintering eggs, N.J. 848.
- aphid, rosy, control, improvement, 50.
- aphid, rosy, overwintering eggs, N.J. 848.
- bitter pit, studies, 345.
- black root rot, studies, 446.
- blister canker, notes, 644.
- blotch, cycle of infection, 240.
- capsid bug, control, 54.
- crown gall and wound overgrowth, correlation, 48.
- curculio, notes, 657.
- die-back, control, Calif. 744.
- diseases, notes, 345.
- fire blight, control, Tenn. 840.
- fire blight resistant varieties, 351.
- flower bud differentiation, time of, 637.
- fruit spot, control, N.J. 838.
- grafts, excessive callusing at union, prevention, Iowa 135.
- grafts, wound overgrowths, development and suppression, 48.
- grafts, wrapping union with tape, effect, Wis. 440.
- industry of Nova Scotia, report of royal commission, 483.
- industry of Washington, economic aspects, 580.
- leafhoppers in Connecticut, Conn.State 451.
- maggot, control, Wis. 453.
- maggot, emergence records, Conn.State 451.
- maggot, insects affecting, Iowa 153.
- maggot, notes, 57.
- maggot, studies, 855.
- measles, studies, N.Mex. 234.

Apple—Continued.
- mildew, effect of rootstock on scion susceptibility to, 644.
- orchards, management, Pa. 229.
- overgrowths and hairy root on nursery stock, 48.
- pomace, stored, pectin in, N.Y.State 712.
- root borer, giant, life history studies N.Mex. 245.
- rootstocks, raising from seeds, 637.
- rootstocks, transplanted, root regeneration on, 637.
- rust, new, in Tennessee, 351.
- scab, control, N.J. 838; Tenn. 149, 840
- scab control, fall applications of fungicides, 541.
- scab control in Wisbech area of England, 648.
- scab, effect of rootstock on scion susceptibility to, 644.
- scab, effect of sulfur dusts, Ind. 134.
- scab, notes, Wis. 440.
- scab, spray tests for, Iowa 135.
- scab, spraying experiments, 351.
- scab, sulfur fungicides for, 541.
- seedlings developed by station, Iowa 135.
- seedlings, hardy varieties, Iowa 135.
- skin, permeability measured by evaporation loss, 638.
- Sporotrichum fruit spot, 351.
- storage rots and causal organisms Wash.Col. 750.
- tree borer, round-headed, control, injury to tree from treatment, 854.
- tree constituents at various seasons, Ind. 134.
- trees—
  - bearing, pruning studies, Mass. 339.
  - effect of pruning at planting time, Nebr. 829.
  - effect of rootstocks, Mass. 339.
  - field experiments with, significance of probable error, N.H. 341.
  - growth, effect of soil conditions in Bitter Root Valley, Mont. 138.
  - nitrogen in, distribution and fluctuation, 229.
  - on Virginia Crab roots, growth, Nebr. 829.
  - pruning, N.C. 136; N.J. 832.

Apples—
- arsenical residue on, Ind. 135; N.Mex. 227.
- arsenical spray combinations for, Mass. 354.
- Baldwin and McIntosh, growth characteristics, N.H. 341.
- bearing spurs, constituents of cluster base, 228.
- bloom period and yield, Ohio 139.
- blooming dates, N.J. 832.

Apples—Continued.
breeding, Idaho 228; Iowa 136.
callus knot formations, prevention, 48.
cider varieties, self-fertility and self-sterility in, 638.
cold storage holdings, U.S.D.A. 784.
cold storage studies, Iowa 135.
consumer demand for, Mich. 84.
fertilizer experiments, 638; Mass. 340.
freezing injury, variation, Oreg. 535.
fruit size and quality, relation to foliage, Wash.Col. 138.
fruit thinning, residual effects, Mich. 639.
grafting, Iowa, 135.
Grimes, respiration studies, Iowa 135.
hemicelluloses in, 25.
in bushel baskets, cold storage holdings, U.S.D.A. 784.
insect and mite enemies, Mich. 652.
leafhopper specking, removal, 50.
marketing, from Cumberland-Shenandoah region, U.S.D.A. 189.
McIntosh, pollination studies, N.H. 341.
nitrate fertilization and keeping quality, Ohio 833.
on tree and in storage, composition, 833.
pollination experiments, 637.
pollination requirements, 41.
shape and quality, relation to position in fruit cluster, 638.
soluble carbohydrate in, effect of nitrate applications, 229.
spray injury, notes, 644.
spray residue, relation to time of last spray, Mass. 355.
spray residue removal, 52, 230, 342; N.J. 833; Ohio 638; Va. 739.
spray schedule for, N.J. 42.
spraying experiments, Tenn. 840; Wis. 440.
sprays for, value of spreaders in, Mo. 340.
storage, effect of increase in ozone, Ind. 133.
storage experiments, 833.
storage, use of insulation and ice in, Ind. 182.
varieties as pollinizers, Mass. 340.
varieties, identification, Mass. 637.
variety tests, Mass. 340; Miss. 39; Vt. 534.
vitamin C in, 895, 896.
waxlike coating, changes in during growth and storage, 739.
Wealthy, fruit bud and spur tissues, composition, 228.
Apricot—
oxidase activity, factors affecting, 214.
peroxidase, inactivation temperature, effect of pH, 214.
rot fungus, overwintering, Calif. 744.
scab or shot hole, control in Goulburn Valley, 648, 649.
Apricots—
effect of injecting sugar solution into soil, Calif. 736.
pollination experiments, 636.
pollination requirements, 41.
sulfuring, large-scale experiments, 509.
Aprostocetus sp., notes, Calif. 53.
Aqueous solutions, freezing point depression, determination, 206.
d-Arabinose from culture medium of tubercle bacilli, 205.
Arborvitae, Chinese, seeding experiments, Ind. 141.
Archips argyrospila, *see* Fruit tree leaf roller.
Areolae distribution on chorion of pigs, 218.
Arginine—
dissociation constants, 10.
in dog blood, determination, 12.
Argyrotoxa semipurpurana, control, 50.
Arizona Station, notes, 300, 798.
Arizona University, notes, 300, 798.
Arkansas Station, notes, 900.
Arkansas University, notes, 900.
Armidillidium vulgare, host of nematodes, U.S.D.A. 181.
Armillaria mellea, notes, 537.
Arrhincephalia in foals, 568.
Arrow grass, poisonous to livestock, Nev. 772.
Arsenic derivatives of cysteine, 201.
Arsenic in animal tissues, tests for, Conn. State 789.
Arsenical—
injury to apple foliage, corrective, 847.
insecticides, treatment with, causes of injury by burning after, 852.
residue on apples, Ind. 135; N.Mex. 227.
residues, removal from apples, Va. 739.
spray combinations for apples, Mass. 354.
substitutes for spraying peach, Tenn. 850.
substitutes, notes, N.J. 849.
Arsenicals—*see also* Calcium arsenate, Lead arsenate, *etc.*
effect on bean plants, 58.
Arthropods, hibernation studies, 244.
Arthur Hoyt Scott Garden and Horticultural Medal, 800.
Artichoke—*see also* Jerusalem-artichokes.
new disease of, Calif. 744.
Ascaridia numidae, parasite of guinea hen, 877.
Ascarids—
anthelmintics for, tests, 874.
in swine, santonin as anthelmintic for, 572.
Ascochyta—
asteris on aster seed, N.Y.State 741.
gossypii, development in culture, 840.
pisi, notes, 345.
Ascochyta species in pea and vetch fields, Ala. 437.

Aserica castanea, distribution and abundance in New York, 57.
Ash trees, carpenter worm injury, 853.
Ashes, wood, *see* Wood ashes.
Asiatic beetle in Connecticut in 1930, Conn. State 451.
Asparagus fern—
  new spinning mite attacking, 59.
  rust disease, notes, Fla. 440.
Asparagus—
  fertilizer combinations, range, N.J. 831.
  nutrient supply, relation to carbohydrates from photosynthesis, N.J. 830.
  plants, male, yields, Calif. 736.
  reductase in, effect of length of day, N.J. 830.
Aspartic acid, synthesis, 203.
Aspen suckers, effect of light burning, 837.
Aspergillus, biochemistry, 566.
Aspergillus—
  luchuensis, phosphorus assimilation by, 419.
  spp. studies by serological methods, 535.
Aspidiotus hederae var. *unipectinata*, notes, 546.
Aspidiotus perniciosus, *see* San Jose scale.
Asses, statistics, U.S.D.A. 486.
Association of Land-Grant Colleges and Universities, proceedings, 888.
Aster yellows—
  host range, 649.
  studies, 448.
  transmission, Calif. 753.
  virus, carrier, 359.
Asterocystis radicis, notes, 540.
Asterolecanium pustulans, control, V.I. 737.
Asters—
  China, diseases, N.J. 352.
  China, Fusarium wilt of, 541.
  China, seed treatment and storage, N.Y.State 741.
  wilt resistance in, Ind. 134.
Astragalus campestris, poisonous to livestock, Ind. 70.
Athysanella group of leafhoppers, key, 247.
Atmosphere, *see* Air.
Atmospheric moisture, *see* Humidity.
Atmospheric pressure and sun spots, correlation, 714.
Atropine, antagonism on gravid uterus of bovine, 869.
Australian aboriginals, standard metabolism, 892.
Autographa brassicae, *see* Cabbage looper.
Autolysis in seeds, 423.
Autoserica castanea grubs, toxicity of lead arsenates to, N.J. 850.
Avitaminosis—
  effect on coefficients of digestibility, 397.
  in fowls new to Germany, 869.
Avocado—
  apoplexy, cause, Calif. 744.
  challenge spot, cause, Calif. 744.
  sun blotch disease, transmission, Calif. 743.
Avocado—Continued.
  trees, composition, relation to chlorosis and tip-burn, 844.
Avocados—
  culture in Porto Rico, 436.
  Diplodia spp. affecting, Fla. 439.
  oil content, determination, Fla. 435.
  preservation and utilization, Hawaii, 788.
  varietal and cultural notes, Fla. 435.
Azolla as green manure, 628.
Azotobacter chroococcum, phosphorus assimilation by, 419.
Azotobacter—
  method for study, 813.
  nitrogen fixation by, 211.
Babcock Memorial Statue, notes, 799.
Babcock, S. M., editorial, 601.
Bacillus—
  aertrycke—
    increasing resistance of mice to, 328.
    notes, 574.
    virulence, effect of amount of oxygen in atmosphere, 375.
  anthracis, bacteriophage for, 264.
  anthracis spores, thermal death point, 568.
  atrosepticus, notes, 347.
  carotovorus, notes, 542; Me. 749.
  enteritidis, *see Salmonella enteritidis*.
  gigas, notes, 870.
  graveolens, notes, Fla. 489.
  hemolyticus, fatal to a hog, 873.
  hemolyticus, serologic studies, 870.
  melanogenes, notes, 347.
  necrophorus, immunizing animals to, Wyo. 176.
  perfringens, notes, 379.
  phytophthorus, notes, Me. 749.
  phytophthorus, studies, 347.
  prodigiosus, virulent to Lymantria caterpillars, 550.
  pyocyaneus pigment, studies, 202.
  radicicola, *see* Nodule bacteria.
  solanisaprus, notes, 347.
  sp. (?), 10 and 14, characteristics, 379.
  subtilis, notes, Fla. 489.
  suipestifer, cause of meat poisoning, 472.
  tuberculosis in cow manure on pasture land, viability, 377.
  typhosus phenol coefficient values of disinfectants, 669.
  whitemori infection in a cow, 268.
Bacon—
  and pork production, cost relations, 662.
  production, use of oil cakes for, 555.
  sugar-cured v. salt-cured, Tenn. 861.
Bacteria—
  activity, effect of exchangeable ions in soil colloids, 813.
  and seed-corn maggot, relation, 360.
  chemical study, 205.
  growth, effect of carbonation, Ill. 873.

Bacteria—Continued.
in milk, soil, etc., *see* Milk, Soil, *etc.*
in respiratory tract of fowls, effect on agglutinins in blood, 270.
phytopathogenic, agglutination tests with, 746.
propionic acid, formation and identification of acids, 711.
variation in, 522.
Bacteriological culture media, *see* Culture media.
Bacteriological technic, treatise, 69.
Bacteriophage—
Brucella abortus, search for, 376.
of *Bacterium pruni*, 240.
relation to Salmonella and pullorum disease, Mich. 180.
specific, for diarrhea of calves, 872.
Bacterium—
abortivo-equinus, notes, 670.
abortus—*see also* Abortion *and Brucella abortus.*
in milk, agglutination titer as indicator, 265.
isolated from gelatinous infiltration in uterus of cow, 669.
ovis, causing abortion in sheep, 377.
campestre, notes, Me. 749.
citri, *see* Citrus canker.
coli and *Staphylococcus pyogenes*, mixed cultures, changes in pH, 568.
lachrymans, notes, 45.
maculicolum, production of agglutinins by, 840.
malvacearum, notes, 646.
marginatum, notes, 542.
paludis, notes, 472.
pruni, bacteriophage of, 240.
pruni, studies, N.C. 146.
radicicola, *see* Nodule bacteria.
solanacearum, notes, Fla. 439.
solanacearum, studies, N.C. 146.
tularense in snowshoe rabbits, 267.
tumefaciens in tomato, migration in, 47.
tumefaciens, notes, 841.
vascularum, notes, 46, 348.
vesicatorium, notes, N.J. 838.
welchii, *see Clostridium welchii.*
Baeoanusia, African species, 552.
Baking—
club manual, revision, Ill. 892.
laboratory, standardization, 890.
powder, carbon dioxide in, determination, 14.
quick breads and cakes at high altitudes, Colo. 91.
tests at high altitudes, Colo. 90, 91.
Balaninus caryae, *see* Pecan weevil.
Bamboo, Coccidae attacking, 248.
Bamboo pest, notes, 546.
Banana—
fruit-eating caterpillar, studies, 248.
peroxidase, inactivation temperature, effect of pH, 214.
seeds, crystalline globulin in, 11.
Bananas—
culture in Palestine, 884.
yield data, V.I. 737.
Banking, Russian cooperative, 389.
Banks—
country, and farm credit problems, 80.
Federal intermediate credit, functioning, 580.
Federal Land, functioning, 580.
Barberry bacterial leaf spot, studies, 750.
Barium fluosilicate, effect on bean plants, 58.
Barley—
breeding, Tenn. 825.
covered smut, control, Calif. 744.
covered smut, notes, 345.
culture experiments, Nebr. 822; Wyo. 127.
culture under dry-farming conditions, N.Mex. 527.
deficiencies for young pigs, 254.
effect of rainfall in different seasons, 223.
glutelins, optical rotation, 108.
grinding, fineness, Wis. 466.
grinding for fattening cattle, Minn. 365.
ground, v. ground yellow corn for poultry, S.C. 557.
grown under glass, moisture fluctuations in, 214.
hybrids, notes, Calif. 728.
improvement, N.J. 824.
leaves, inheritance of length and width, 521.
pedigree 38, characteristics, Wis. 431.
planting tests, N.J. 824.
powdery mildew resistant varieties, Ind. 144.
preparation for pigs, Oreg. 861.
production in South Dakota, S.Dak. 629.
production, trend and distribution, Calif. 280.
rosette, notes, 538.
rust resistance, studies, Ind. 143.
scab, varietal resistance, Wis. 441.
scabbed, feeding value, 254.
seeding experiments, Idaho 222.
smut, control, 235.
Spartan, characteristics, Mich. 729.
spot blotch, control, Mich. 745.
stripe, control, 842; Mich. 745.
stripe disease, ceresan treatment of seed, Iowa 145.
stripe disease, control, 235.
varieties for cut-over land, Idaho 222.
variety tests, Colo. 33; N.Mex. 221; Nebr. 432, 822; Utah 222, 627; Wyo. 127.
winter, pasture yield and utilization, Okla.Panhandle, 129.
yields, effect of plowing time, Wyo. 127.
Barns, dairy—
stall floors for, Iowa 183.
ventilation, fan system for, Iowa 183.

Barometric pressure, yearly variations over west Pacific, 617.
Bartsia spp., notes, 345.
Bases in salt solutions, thermodynamic properties, 611.
Basidiomycetes, spore discharge, 442.
Basisporium gallarum on corn, Iowa 145.
Bats, parasites of, key catalogue, 650.
Bay tree, psyllid enemy of, 247.
Bean—
aphid, *see Aphis rumicis*.
bacterial disease, studies, 44.
beetle, Mexican—
climatic limitations, 253.
in Connecticut, distribution, Conn. State 451.
notes, N.J. 849; N.Mex. 245.
sprays, tolerance of beans to, 58.
chocolate streak, notes, 345.
halo spot, notes, Ga. 142.
mosaic, transmission, 747.
mosaic, types, Mich. 745.
pod-borer eggs, notes, 851.
pod-borer on Limas, distribution, life history, and food plants, 457.
rust, sex mechanism in, 445.
seed, germination, effect of disinfectants, 44.
thrips injury to pears, Calif. 754.
thrips, life history, Calif. 754.
weevils, notes, 246.
Beans—*see also* Soybeans, Velvetbeans, *etc.*
blackeye, variety tests, Calif. 744.
Chinese, pentatomid pest of, 359.
cull, feeding value for lambs, Idaho 255.
developed by hybridization, resistant to high temperature, Calif. 727.
effect of windbreaks, Wyo. 127.
French, in Sudan, new species of Erythroneura on, 359.
home-canned string, botulism from, 98.
kidney, variety tests, Tenn. 825.
Lima, bacterial spot, overwintering, Mich. 746.
Lima, time-of-planting studies, Ala. 434.
pinto, cooking in various ways, N.Mex. 288.
pinto, culture under dry-farming conditions, N.Mex. 527.
snap, fertilizer experiments, Miss. 39.
snap, variety tests, Miss. 39.
string, car-lot shipments from Florida and competing areas, Fla. 886.
string, shipments, Fla. 431.
time-of-planting studies, Ala. 434.
tolerance to sprays and dusts for beetle control, 58.
variety tests, N.Mex. 221; Utah 222, 627.
vine-selected seed, value, Wyo. 127.
white, left in field after ripe, losses from, Mich. 729.
Bearing wear, effect of lubricants, Calif. 777.
Beauveria bassiana on larvae of European corn borer, 249.
Bedbugs—
hatching of eggs, 244.
host selection and cannibalism, 247.
Beech mottle leaf disease, notes, 543.
Beef—*see also* Cattle, beef.
muscle, nutritive value, 289.
production and quality, factors affecting, U.S.D.A. 364.
production, eastern, problems, 253.
production in corn belt, 253.
research work in England, 482.
roast, shrinkage, relation to fat content and cooking temperature, 393.
Beekeeping—
in Cyprus, 58.
in Egypt, 58.
in Missouri, Mo. 856.
new and old, treatise, 362.
treatise, 758.
Bees—
blind louse of, 657.
brood-nest temperatures, effect of low external temperatures, 855.
Chinese, studies, 546.
evaluation for pollination by, 855.
exposed to high external temperatures, 855.
foulbrood, *see* Foulbrood.
Italian and Caucasian, differences, Wyo. 157.
leaf-cutter, taxonomy and biology, N.C. 153.
metabolism, effect of temperature, 855.
of North Carolina, N.C. 153.
package, summary, 552.
reaction to light, 362.
studies, N.J. 849.
Texas, notes, Tex. 899.
wintering, N.C. 153.
Beet—
diseases in Prussia, 535.
flea beetle, notes, 651.
leafhopper, new automatic trap for, 845.
mildew, cause, Calif. 744.
mosaic disease, studies, Wash.Col. 348.
seed treatment, N.J. 839.
Beetle, new to Michigan, in dried sweet corn, Mich. 756.
Beetles—
collecting, new methods, 355.
of America north of Mexico, manual, 57.
Beets—
cultivation experiments, N.Y.Cornell 635.
effect of potassium deficiency, N.J. 831.
fertilizer experiments, R.I. 534.
field or fodder, *see* Mangels.
production, machinery for, developing, 275.
raising in Europe, labor problems, 581.
sugar, *see* Sugar beets.

Bembecia marginata, *see* Raspberry root borer.
Bemisia gossypiperda on cotton in Punjab, 654.
Bentonites and soil colloids, relation, Calif. 708.
Benzol for control of head lice, 453.
Berries, *see* Fruits, small, *and* Raspberries, Strawberries, *etc.*
Bessel's formula and Student's method, comparison, 31.
Bethylidae, parasites of stored grain insects, 552.
Bibliography of—
adenoma, intestinal, of swine, 572.
adrenaline action on bovine uterus, 869.
agricultural situation in 1929–30, 681.
angiosperms, chromosome numbers in, 522.
animal aggregations, 845.
aphids affecting truck crops, Va.Truck 156.
bacteriophage, relation to Salmonella and pullorum disease, Mich. 180.
birds of Haiti and Dominican Republic, 545.
birds of Philippines, 545.
blood of horses, individual reactions, 567.
blood sugar of sound and diseased animals, 869, 870.
butterflies migration, 758.
carbohydrate metabolism of mammals, 490.
coccidiosis, bovine, Va. 774.
Coleoptera, tropisms and sense organs, 253.
corn borer parasite, U.S.D.A. 253.
corn, genetics, breeding, and improvement, 324.
corn insects, Ohio 155.
coryza and fowl pox, 674.
cotton, genetics, breeding, and improvement, 324.
cottony cushion scale parasite, 252.
cranberry false blossom transmission, 358.
Delphinium, N.Y.Cornell 641.
diabetes mellitus of dog and cat, 567.
distomatosis of cattle, blood picture, 378.
dogs, cornea, affections of, 870.
eight-toothed larch bark beetle, 852.
elm disease, 352.
feeding stuffs, grinding, 677.
fig insects in California, U.S.D.A. 357.
foot-and-mouth disease, importance of dung disposal, 869.
foulbrood comb disinfection, 252.
fowl diphtheria, immunization, 567.
fowl pox and coryza, 674.
fowl pox immunization, 567.
fur-bearing animals, parasites and parasitic diseases, 271.
gestation, determination, 869.
grain bug, epidemiology, 852.
Bibliography of—Continued.
hay, artificial drying, 577.
hemoglobinemia, puerperal, 775.
Hymenoptera, parasitic, polyembryony among, U.S.D.A. 157.
Incurvaria trimaculella quadrimaculella, 550.
injections, liability in undertaking, 870.
insecticides, contact, efficiency, 357.
insects, hatching of eggs, 244.
insects, relation to weather and climate, 851.
laurel, poisonous to livestock, U.S.D.A. 177.
leafhopper, six-spotted, 359.
Lygus spinolae of Schilcher vine in Styria, 851.
M. F. Maury, 509.
Mallophaga of domestic animals, 869.
mealybugs, control, Calif. 156.
mice, laboratory, 650.
milking, mechanical, present status, 576.
muskrats, 242.
mycology, field, 746.
peat soil temperatures, relative to summer frost, 510.
piroplasmosis, bovine, in Germany, 870.
plants poisonous to livestock in Australia, 568.
pork quality, factors affecting, Ind. 64.
pullorum disease, short interval testing, N.C. 181.
quail of California, 352.
quinine action on bovine uterus, 869.
rickets, indirect ray therapy, 567.
rural standards of living, U.S.D.A. 786.
sawflies of subfamily Dolerinae, 657.
seed weevils, morphology and biology, 551.
soil temperatures, U.S.D.A. 316.
soils, physical properties and bearing value, 879.
sugarcane pest and diseases, 356.
teeth, mottled enamel of, 396.
thallium, pharmacology and use in rodent control, U.S.D.A. 151.
thermal death point of some bacteria, 569.
three-day sickness in cattle, 673.
thrush, 869.
tubercle bacilli cultivation, 567.
tuberculosis, bovine, serological diagnosis, 869.
tuberculosis of reproductive organs of bovine, 869.
tumors, so-called, 870.
vaccine bodies, Guarnieri's, 870.
vaccinia and variola, histology, 571.
vitamins, 588.
wheat, cost of production, U.S.D.A. 484.
Big Ten mixture, feeding value, Iowa 168.

Bile of cattle, dogs, and fowl, pH value, 868.
Billbugs on corn, Mich. 153.
Bindweed, anatomy, Calif. 533.
Biochemistry, plant, treatise, 212.
Biorhiza pallida, biology, 657.
Bios and vitamin B_2 and vitamin B_1, properties and differentiation, 206.
Birch—
borer, bronze, infestation, relation to lowered tree vitality, 454.
leaf-mining sawfly, life history and control, 59.
seed, percentage of viability, determination, 642.
Bird—
Preservation, International Committee, bulletin, 544.
refuges, local, U.S.D.A. 50.
Birds—
as predators of wireworms or click beetles, 551.
east of Rocky Mountains, treatise, 751.
in Peterboro and Labrador Pond region, 545.
migration in British Isles and in Norway, 414.
of Alaska, laws and regulations, U.S.D.A. 151.
of Bermuda, 651.
of China, revision of tentative list, 352.
of Denmark, 545.
of Haiti and Dominican Republic, 545.
of Nyasaland, 352.
of Philippines, 545.
of Porto Rico, 243.
parasitized by cowbirds, list, 751.
wild, epidermoid cancers on feet, Mich. 475.
Birth rate, declining, agricultural significance, 686.
Birth weight of young, relation to maternal nutrition, 691.
Black scale parasites—
expedition to Eritrea in search of, Calif. 755.
notes, 552; Calif. 756.
Blackberries—
effect of irrigation, Oreg. 740.
varietal and cultural notes, Fla. 435.
Blackberry—
bushes, control in New Zealand, 533.
seedlings from cross of thorny and thornless types, R.I. 534.
Blackhead in turkeys, control, Conn.Storrs 777; Mich. 176, 772.
Blastothrix sericea, notes, 549.
Blissus leucopterus, *see* Chinch bug.
Blood—
calcium of laying hens, studies, 367.
changes in hens on soybean rations, 367.
coagulation in sweetclover disease, 267.
coagulation period in normal and diseased animals, 264.
groups in man, inheritance, 324.
Blood—Continued.
iodine in, determination, 314.
lines that produced winning carcasses, 254.
of dogs, arginine determination in, 12.
of equines and bovines, alkali reserve in, 568.
of horses, individual reactions, 567.
of livestock, individual reactions, 870.
of starved animals, toxicity of, 772.
plasma of dairy cattle, calcium and phosphorus in, biometry, 261.
samples from chickens, heart probe method, 556.
sugar of sound and diseased animals, 869, 870.
Blowflies in Australia, 551.
Blowfly, hatching of eggs, 244.
Blueberries—
culture, N.J. 436.
insects affecting, Me. 756; N.J. 849.
studies, N.J. 834.
variety tests, Miss. 39.
Blueberry—
flea beetle, notes, Me. 757.
leaf beetle, notes, Me. 757.
maggot, notes, Me. 757.
Bluegrass, Kentucky, fertilizer experiments, Conn.Storrs 727.
Bobcat, methods of trapping, U.S.D.A. 845.
Bobwhite quail, host of spirurids, U.S.D.A. 182.
Body fluids and organs, iron determination in, 312.
Boll weevil—
control, Ala. 449.
hibernation in Laguna District of Mexico, 851.
Bollworm—
notes, N.Mex. 245.
pink, control, V.I. 758.
pink, notes, 246.
pink, of cotton in Algeria, 56.
pink, sources of infestation, 655.
Sudan, summary, 359.
Bone—
chewing in cattle, 267.
composition, 893.
ground, inspection and analyses, N.J. 23.
meal v. raw rock phosphate for dairy cattle, Mich. 766.
strength in cattle, relation to feed, 254.
Books on—
agricultural economics, outlines, 678.
agricultural machinery, 879.
air, realm of, 413.
animal aggregations, 845.
animal diseases, general epidemiology, 566.
animals, venomous, and insects of medical importance, 244.
bacteriological technic, 69.
beekeeping, 362, 758.
biochemistry, plant, 212.
birds east of Rocky Mountains, 751.

Books on—Continued.
botany, 23, 24.
brooders, battery, operation, 65.
carnations, 641.
cattle breeding, 857.
cattle, breeding losses, prevention, 378.
chemicals and drugs, analysis, 314.
chemistry and cookery, 392.
cookery and chemistry, 392.
cotton plant, 223.
dairy farming systems, 885.
dairy industry in Australia, 864.
dairy science, 864.
dairying principles, 865.
diet and nutrition therapy, 890.
drugs and chemicals, analysis, 314.
entomology, 353.
entomology, agricultural, 545.
farm business administration, introduction to theory, 579.
five-year plan of Soviet Union, 386.
food allergy, 890.
food chemistry and nutrition, 392.
forestry statistics, mathematical theory of, elements, 678.
gardening, 227.
grapes, culture, 640.
heredity, 724.
home maintenance and repair, 299.
horses, light, breeding, 556.
horticulture, 227.
insects, ticks, mites, and venomous animals of medical importance, 244.
jute, 34.
law of cooperative marketing associations, 585.
light, artificial, 195.
livestock, international atlas, 660.
livestock judging, elements, 586.
livestock, types and market classes, 60.
marketing associations, cooperative, law of, 585.
marketing principles, organization and policies, 683.
markets, organized commodity, 683.
materials, raw, international control, 386.
medical terms, 566.
microclimate and plant climate, 413.
microorganisms in soil, 321.
microscopy, chemical, 309.
mycology, field, 746.
Netherland East Indies, 388.
nutrition and diet therapy, 890.
nutrition and food chemistry, 392.
pigs, embryology, 556.
plant climate and microclimate, 413.
plants, environmental complexes as dynamic systems, 212.
poultry raising, 64.
quail, bobwhite, 544.
rabbits for food and fur, 663.
research and reports, 479.
research, scientific, methods and status, 487.
rural economics, 578.

Books on—Continued.
rural sociology, systematic source book, 687.
Russia, five-year plan in, 386.
sex hygiene and reproduction of cattle, 378.
sheep, range, and wool in Western States, 62.
soil management, 317.
soil science, 714.
South Dakota State College, history, 189.
statistics, mathematical theory of, elements, 678.
sugar of Porto Rico, 633.
vitamins, 587.
water supply and utilization, 878.
weather, 413.
wheat in Canada, 483.
zoology, economic, 242.
Boophilus annulatus calcaratus, transmitter of blood parasites in Caucasus, 870.
Borax v. sodium fluosilicate in controlling house flies, 458.
Bordeaux mixture—
effect on onion yield, Mass. 343.
fungicidal value, Mo. 340.
v. lime-sulfur for apple scab, Tenn. 150.
Bordeaux paste for citrus gummosis, 351.
Borkhausenia pseudospretella, notes, 246.
Borna disease—
of horses, 870.
of sheep and cattle, experimental enzootic, 269.
virus, resistance to drying, 773.
Boron—
deficiency, effect on citrus, Calif. 150.
requirements of citrus, Calif. 722.
Boronia roots, eelworms on, 345.
Botanical terms used in range research, glossary, U.S.D.A. 623.
Botany—
teaching, program for, 888.
textbook, 23, 24.
Botryodiplodia spp., notes, 344.
Botrytis—
cinerea on aster seed, N.Y.State 741.
hyacinthi, notes, 542.
polyblastis n.sp., description, 543.
tulipae, notes, 542.
Botulism and ducks, 271.
Botulism and home canning, 98.
Boutonneuse fever—
in Tunis, transmission, 871.
virus, hereditary in *Rhipicephalus sanguineus*, 871.
Boxwood—
diseases, N.J. 352.
leaf miner, summary, 249.
Brachyacma palpigera, notes, 457.
Brachyplatus subaëneus, studies, 546.
Brachyrhinus—
ovatus, notes, Mich. 153.
rugosostriatus, studies, Calif. 53.

Brachyrhinus—Continued.
sulcatus in soil of perennial beds, Conn. State 451.
sulcatus, studies, Calif. 53.
Bradycardia, effect of vitamin B deficiency, 595.
Bran, variations in local prices, Mo. 485.
Brass, corrosion rate in vinegar, Calif. 709.
Braula coeca, studies, 657.
Bread—*see also* Flour.
and wheat prices, Ohio 481.
making, honey v. sucrose in, 394.
Breads, quick, baking at high altitudes, Colo. 91.
Breeding, *see* Animal breeding *and specific animals and plants*.
Bremus americanorum, bionomics, 252.
Brenthidae of China, 546.
Brevicoryne brassicae, *see* Cabbage aphid.
British Mosquito Control Institute, report, 361.
Broadcasting, educational, 888.
Broccoli, dried, vitamin A in, 193.
Bromegrass—
and alfalfa mixtures, yields, Mont. 528.
water requirements, 128.
Bromus—
hordeaceus, nutritive value, effect of leaching, Calif. 658.
inermis seed, impurities, N.Dak. 133.
Bronchitis, infectious—*see also* Laryngotracheitis.
of fowls, 72; N.J. 875.
of fowls, spirochetes in, 877.
on poultry ranches, Calif. 770.
Broncho- and pneumono-mycosis of horses, 567.
Bronze, phosphor, elastic behavior, 76.
Brooders—
battery, operation, treatise, 65.
electric, advantages and disadvantages, 576.
electric, studies, Ind. 183.
Broom rape, notes, 345.
Brown patch—
experiments and notations, 647.
on turf, control, 44.
Brown rot—
fungi, American, nomenclature, 540.
inoculations on pear flowers, 644.
Brown-tail moth parasite, biology and habits, 758.
Brucella abortus—*see also Bacterium abortus and* Abortion.
agglutinating sera, bactericidal and therapeutic value, Mich. 175.
agglutinating sera, intermediate zone phenomenon, 376.
agglutinins in blood of sows, 269.
bacteriophage, search for, 376.
dissociation in vitro into R and S types, Calif. 770.
from human fetus, isolation, 773.
infection, complement-fixation and agglutination tests, 871.
Brucella abortus—Continued.
infection in guinea pigs, effect of killed cultures and filtrates, 376.
infection in Iowa, 671.
isolation from raw market milk, 265.
lethal temperatures for, 265.
pathogenicity for monkeys, Mich. 174, 175.
serologic reactions of men, relation to occupation, 569.
strains, identification, 266.
Brucella—
cultures, acidity produced in, 265.
group, metabolism studies, 569.
infection studies, progress in, 70.
Brucella—
melitensis of cattle, studies, 268.
spp., differentiation, 376.
suis in swine, 873.
suis, relation to abortion, Mich. 670.
Brucelliasis of swine, 873.
Bruchidae-Lariidae, morphology and biology, 551.
Bruchidius—
dentipes, morphology and biology, 551.
incarnatus, morphology and biology, 551.
Bruchus—
analis, morphology and biology, 551.
chinensis, *see* Cowpea weevil.
obtectus, *see* Bean weevils.
pisorum, *see* Pea weevils.
Bryobia practiosa, *see* Clover mite.
Buckeye sprouts and nuts, poisonous to livestock, Ind. 70.
Bud moth, control, improvement, 50.
Buffalo fly in Australia, 551.
Bulbs—
growing in Holland and disease control, 542.
importation into Canada, condition, 542.
industry in United States, survey, U.S.D.A. 642.
Bulls—*see also* Sires.
average ages in six breeds of cattle, 554.
dairy, care and management, S.C. 371.
genitalia of, studies, 671.
housing and feeding, 562.
Bunt, *see* Wheat smut, stinking.
Bupalus piniarius, parasites, 852.
Bureau of—
Agricultural Economics and Federal Farm Board, cooperation, 585.
Animal Industry researches on infectious abortion, 265.
Business—
activity, relation to agriculture, 276.
and agriculture, post-war interrelations, 79.
cycle and agriculture since 1920, 680.
cycles, 888.
Butter—
absorption curves of acids, 805.
air in, 268.

Butter—Continued.
analysis. microbiological, suggested methods, 110.
bacteriology, Iowa 67.
bacteriology, microscopic examination method, Iowa 667.
chemical analysis, 110.
cold storage holdings, U.S.D.A. 784.
effect on ice cream mix, Mich. 769.
fatty acids in, variations, 666.
keeping qualities, studies, Ind. 172.
quality, effect of feeding clover silage, 372.
sticky, crumbly texture, cause, Calif. 768.
Swedish, consistency, 867.
Butterfat—
composition, effect of feeding menhaden oil, 663.
in milk, effect of corn v. sorghum silage, N.C. 170.
in milk, relation to blood lipids, 261.
in whole milk deliveries, Wis. 482.
production and feed cost of dairy cows, correlation, 562.
production, cost, Minn. 282.
variations in local prices, Mo. 485.
Butterflies, migration, 758.
Buttermilk—
condensed, for poultry, Ind. 167.
dried, feeding value, Iowa 661.
dried, feeding value with meat scrap, Ind. 167.
fat losses in, Minn. 173.
production and drying, Wis. 482.
N-Butyl chloride as anthelmintic, 874.
Cabbage—
aphid, life history, habits, and control, Va.Truck 156.
aphid parasites, notes, 359.
Chinese, maggot injury, Me. 749.
clubroot in soil, reaction and treatment, 236.
clubroot, notes, 842.
cooperative cultural and varietal tests, N.Mex. 227.
cultivation experiments, N.Y.Cornell 635.
fertilizer experiments, N.Mex. 227; R.I. 534.
flea beetle, notes, Mich. 153.
Fusarium resistant, of Jersey Wakefield type, 237.
heads, solidity, determining, Calif. 137.
Iacope, development, 237.
looper, control, Tenn. 851.
maggot, control, 656.
maggot, effect of treatment, Conn.State 451.
maggot, relation to bacterial rots of crucifers, Me. 749.
paper mulch experiments, Ohio 435.
shipments, Fla. 481.
shipments from Florida and competing areas, Fla. 886.
vitamin B complex in, 590.
Cabbage—Continued.
yellows resistant strains, 237; Iowa 144; Wis. 441.
Cacellus oecanthi, notes, Calif. 58.
Caconema radicicola, biological studies, Calif. 754.
Cactoblastis cactorum, biological control, 547.
Cactus, prickly-pear—
biological control, 547.
eradication, 533.
Cage, nonmetal, for small animals, 897.
Cage, waterer, and feed cup for experimental rats, 897.
Cakes, baking at high altitudes, Colo. 91.
Calcium—*see also* Lime.
arsenate spray, fungicidal properties, 537.
assimilation by cows, studies, Wis. 465.
availability for bone formation in chick, 257.
balance of heavily milking cows, 260.
chlorate for weed control, Wis. 432.
chloride, treatment of milk fever and grass staggers, 472.
compounds, relative utilization by chicks, 257.
cyanamide, availability studies, N.J. 816.
cyanide-raw linseed oil mixture, injury to apple trees, 854.
deficiency, effect on fruit trees, 638.
deficiency, effect on peas, 216.
deficient rations, effect on breeding pigs, 63.
fluoride, effect on calcium retention of pigs, 366.
hydroxide, fertilizing value, Fla. 434.
hydroxide, free, in set cements, estimation, 273.
in blood, effect of vitamin B deficiency, 95.
in blood of dairy cattle, variations, 261.
in blood of laying hens, distribution in circulation, 367.
in blood of laying hens, effect of calcium intake, 367.
in blood plasma of dairy cows, relation to phosphate, 261.
in blood serum, effect of sweetclover rations, 363.
in hypercalcemia, source, 194.
in striated muscle of rachitic animals, 553.
ions, binding by serum, 893.
metabolism, effect of irradiated ergosterol, 95.
metabolism in chickens, 877.
metabolism of women, factors affecting, Mich. 794.
nutrition of peas, effect of length of day, Mich. 722.
oxalate crystals in cell wall of peanut plants, N.C. 118.

Calcium—Continued.
requirements of growing chicks, 557.
requirements of heifers, 767.
retention, effect of cellulose in vegetables, 91.
studies, Wis. 490.
sulfate, *see* Gypsum.
thioarsenate, fungicidal properties, 537.
utilization from various forms of milk, 290.
Calendra spp., egg parasite of, 759.
California—
Station, notes, 199, 497.
Station, report, 796.
University, notes, 497.
Calliphora spp., notes, 551.
Callus overgrowths, studies, Wis. 440.
Calves—
beef, wintering, Nebr. 857.
colloidal iodine feeding, effect, N.J. 864.
dairy, feeding, care, and management, 561.
dairy, milk diet supplements, Iowa 65.
fattening, Oreg. 659.
fattening, comparison of rations, 553.
feeding experiments, Ind. 169.
milk substitutes for, Mass. 370.
raising, Calif. 765.
raising in England, methods, 561.
raising on minimum amount of milk, Mich. 766.
range, in Arizona, fattening rations, Ariz. 60.
stocker, wintering, Ala. 459.
vitamin D requirement, Wis. 465.
young, metabolism trials, Iowa 170.
Cambarus immunis spinirostris, notes, 73.
Camponotus herculeanus pennsylvanicus, notes, Ohio 852.
Campsomeris—
radula, notes, 59.
tasmaniensis, notes, 59.
Canadian—
personnel, changes in, 799.
Society of Technical Agriculturists, meeting, editorial, 306.
Society of Technical Agriculturists, papers and reports, 889.
Cancer, spontaneous, in mice, origin, complication to genetic analysis, 217.
Candies, packaged fruit jelly, drying, prevention, Calif. 709.
Cane beetle, important, in Negros, 551.
Canna, edible, starch studies, Hawaii 712.
Canned foods, vitamins in, 293.
Canned vegetables, spoilage, identification of organisms, Fla. 488.
Canning—
crops, insects affecting, Ind. 153.
methods, home, Ind. 191.
of vegetables and botulism, 98.
Cantaloupe, *see* Muskmelon.
Capillaria annulata in Hungarian partridges, 878.
Capitophorus fragaefolii, notes, Fla. 439.
Capnodium sp., notes, 344.
Capnoides caseana, poisonous to livestock, Nev. 668.
Capons, injections of female and male hormones, effects, 28.
Capper Award, 1931, notes, 500.
Capsid bugs on currants, control, 653, 654.
Carbohydrate—
complex, from culture medium of tubercle bacilli, *d*-mannose and *d*-arabinose in, 205.
metabolism of mammals, 490.
Carbohydrates—
in apples, effect of nitrate applications, 229.
in seeds, storage, Iowa 119.
in strawberry plants, 231.
Carbon dioxide—
in baking powder, determination, 14.
storage of fruits, vegetables, and flowers, 412.
Carbon tetrachloride poisoning in cattle, 268.
Carbon, total, procedure, 312.
Carbonates in soils, determination, new method, 505.
Carcinoma, mediastinal, in a horse, 870.
Carnation—
blight, notes, Mass. 344.
diseases, N.J. 352.
Carnations—
culture experiments, N.J. 835.
insects affecting, 652.
treatise, 641.
variety tests, N.C. 136.
Carotene—
and vitamin A, relation, 612; Wis. 491.
as vitamin A, physiological activity, 208.
conversion into vitamin A by fowls, 894.
identity and naming, 216.
in carrots, forms, 804.
pure, and vitamin A, 804.
Carpenter ants, notes, Ohio 852.
Carpenter worm injury to ash in North Dakota, 853.
Carpocapsa pomonella, *see* Codling moth.
Carrot rust fly—
biology and control, Mass. 355.
control in New York, 57.
in Michigan, Mich. 458.
Carrot yellows, transmission, Calif. 753.
Carrots—
cultivation experiments, N.Y.Cornell 635.
culture under dry farm conditions, Utah 627.
dried, vitamin A in, 193.
fertilizer experiments, R.I. 534.
yields, effect of source of potash, R.I. 526.
Casein—
digestion with papain-cyanohydrin, splitting off of tyrosine and tryptophane, 711.
drying plants, location, Wis. 482.

Casein—Continued.
effect of heat on biological value, 789.
grain-curd, testing pH, bromcresol green paper in, 566.
Caseinogen, purified, biological value, 587.
Caseins of milk, 259.
Catalase in honey, 856.
Catalpa mealybug in Connecticut, Conn. State 451.
Cats, Siamese, temperature effects on color, 523.
Cattle—*see also* Calves, Cows, Heifers, Livestock, *and* Steers.
Arkansas native, beef producing qualities, Ark. 761.
beef—
fattening, value of grazing for, Fla. 459.
feeding experiments, Ala. 459; Nebr. 857; Wyo. 159.
inbreeding, 254.
industry of Montana, costs and incomes, Mont. 583.
industry of Virginia, economic factors, U.S.D.A. 282.
pasture studies, Tenn. 856.
statistics, U.S.D.A. 486.
black spotting, and milk production, 523.
bone-chewing or depraved appetite in, 267.
breeding, basis of, treatise, 857.
breeding by artificial insemination, 27.
breeding losses, prevention, treatise 378.
carbon tetrachloride poisoning, 268.
dairy—*see also* Cows.
effect of heavy cottonseed meal feeding, 260.
experiments, N.J. 864.
feeding, Ill. 561.
feeding experiments, Ind. 169.
feeding standards, interpretation, 663.
feeding systems, Mass. 370.
mineral requirements, Mich. 468.
nutrient requirements, 466.
pasture management, N.C. 170.
statistics, U.S.D.A. 486.
diseases—*see also specific diseases.*
hematology, 378.
embryos, development of pigment in, 524.
feeding and breeding experiments, Can. 60.
feeding, determining profit in, 254.
feeding experiments—*see also* Cattle, beef, *and* Cattle, dairy.
N.C. 170; Okla.Panhandle 171.
feeding, returns per acre, Ohio 659.
grub larvae, oesophageal stage, in Indian cattle, 250.
Guernsey, lactation curve, stability, 254.
imported pedigree, disease among, at Nairobi, 472.
Cattle—Continued.
inheritance of morphological characters, 122.
on special ration, urine, calcium and albumin in, 869.
path of medicaments administered per os, 870.
plague, *see* Rinderpest.
poisoning, *see* Livestock poisoning, Plants, poisonous, *and specific plants.*
polyphyletic origin, 522.
purebred Aberdeen-Angus, beef producing qualities, Ark. 761.
ranch, organization and management, S.Dak. 187.
sex ratio in, Wis. 424.
sound and tubercular, blood picture, 868.
sterility in, 567.
three-day sickness, 673.
tuberculin-tested, reactors in, 71.
variations in local prices, Mo. 485.
warts on, U.S.D.A. 673.
water consumed, effect of drinking cups, Iowa 169.
Cedar—
and apple rust galls, strains, Iowa 145.
bark beetle infestation, relation to lowered tree vitality, 454.
western red, strength of wood, effect of extractives, 779.
Celery—
fertilizer experiments, N.Y.Cornell 137; R.I. 534.
late blight, notes, Mich. 745.
production on muck soils, N.Y.Cornell 137.
research work in England, 482.
shipments, Fla. 481.
shipments from Florida and competing areas, Fla. 886.
yellows resistant plants, selection, Mich. 745.
yellows, transmission, Calif. 753.
Cell wall formation, mechanism, 215.
Cellars, farm house, for potato storage, remodeling, N.H. 578.
Cells, direct counting under microscope, new method, 324.
Cells, stimulation, 119.
Cellulose—
determination, development of methods, Iowa 110.
in straw, determination, 314.
in vegetables, effect on availability of calcium and phosphorus, 91.
thermophilic fermentation products, 411.
Cements, free calcium hydroxide in, estimation, 273.
Census of distribution, first, results, 889.
Cephaleuros mycoidea, notes, 344.
Ceraptocerus mirabilis, notes, 549.
Ceratitis capitata, *see* Fruit fly, Mediterranean.

Ceratophyllus—
fasciatus, *see* Rat fleas.
wickhami, hatching of eggs, 244.
Ceratostomella—
fimbriatum, control, N.C. 147.
fimbriatum, disinfectants for, 647.
paradoxa, perfect stage of *Thielaviopsis paradoxa*, 535.
Cercospora—
beticola, notes, Iowa 145; N.J. 839.
fusca, notes, Fla. 440.
personata, notes, Ga. 142.
sacchari, toxic substance produced by, 238.
Cercosporella caryigenum, notes, Fla. 440.
Cereal—
diseases—*see also specific hosts*.
in Prussia, 535.
studies, Mich. 745.
proteins, effect of heat on biological value, 789.
rust, *see* Rust *and specific hosts*.
Cereals—*see also* Grain *and specific grains*.
manganese in, Wis. 491.
milled, insects in, electric sterilizer for killing, Conn.State 451.
problem, solution, relation to improvement of agriculture, 582.
variety test plats, plan for laying out, 626.
vitamins B and G in, Ill. 589.
Ceresan—
for barley stripe disease, Iowa 145.
fungicidal value, Mich. 149; N.C. 146.
Ceromasia sphenophori, notes, 497.
Cestrum parqui, poisoning of ruminants by, 378.
Chaetocnema tibialis, notes, 651.
Chaetophlepsis orbitalis n.sp., description, 656.
Chain-spotted geometer, notes, Me. 757.
Chalcid control in alfalfa-seed production, U.S.D.A. 552.
Chalcosoma atlas on coconut palms, 58.
Chamiza, culture experiments, N.Mex. 222.
Charcoal—
ash-free adsorbent, adsorption from solution by, 412; Mich. 413.
granulated, from abdominal cavity, distribution, 870.
Merck's granulated, effect on pH of coli and staphylococcus cultures at fever heat, 567.
Chayote in Porto Rico, pickle worm in, 851.
Cheese—
American, standardization of milk for, Wis. 374.
cold storage holdings, U.S.D.A. 784.
cottage, manufacture and marketing, Iowa, 667.
cream, use of dry skim milk in, N.Y.State 374.
Gouda, subsequent blowing, 867.
Holland, effect of feeding clover silage, 372.
industry, foreign type, in Wisconsin, Wis. 83.
Cheese—Continued.
marketing, in England and Wales, 386.
sweet curd cottage, manufacture, 867.
Cheilospirura—
hamulosa, developmental stages, U.S.D.A. 181.
spinosa, developmental stages, U.S.D.A. 181.
Chelidonium brevicorne, notes, 547.
Chemicals—
and drugs, analyses, treatise, 314.
aromatic, tests as codling moth bait, N.Mex. 244.
Chemistry and cookery, treatise, 392.
Chenopodium oil as anthelmintic, 874.
Cherries—
cooperative cultural and varietal tests, N.Mex. 227.
maraschino, bleaching and dyeing, Oreg. 616.
pollination experiments, 636.
pollination requirements, 41.
sour, lime-sulfur v. Bordeaux mixture, Mo. 340.
spray schedule for, N.J. 42.
varieties, pH of, Vt. 534.
variety tests, N.Mex. 227.
Cherry—
aphid, black, notes, Mich. 153.
bacteriosis, notes, 644.
case-bearer, notes, Mich. 697.
case-bearer, outbreak, Wis. 453.
fruit fly, notes, 57; Mich. 153.
kernel oil, constituents and uses, 309.
leaf spot, control, Nebr. 837.
leaf spot resistant seedlings, Tenn. 840.
trees, growth and yield, effects of pruning, W.Va. 41.
wild, poisonous to livestock, Ind. 70.
Chestnut—
blight in Michigan, Mich. 150.
borer, two-lined, infestation, relation to lowered tree vitality, 454.
Chick embryos—
chorio-allantoic membrane susceptibility to fowl pox virus, 876.
growth, effect of breed, 725.
Chicken pox control project, State-wide, 574.
Chickens—*see also* Chicks, Fowls, Hens, Poultry, *and* Pullets.
blood samples from, heart probe method, 556.
broilers, crate fattening, N.C. 168.
broilers, dry v. wet mash for fattening, Ind. 167.
calcium and phosphorus metabolism, effect of vitamin D, 558.
calcium and phosphorus metabolism in, 877.
changes in organism, effect of rations, 557.
effect of pokeweed berries, 574.
host of *Tetrameres americana*, U.S.D.A. 181.
thymectomy in, effect, 220.

Chickens—Continued.
variations in local prices, Mo. 485.
White Leghorn, growth, Ill. 368.
Chicks—
antirachitic value of S-1 lamp radiation, 559.
bone formation, availability of calcium for, 257.
brooding, 662.
calcium and phosphorus requirements, 557.
care and management, 662; N.J. 368.
growing, rations for, 257; Iowa 168.
growth and development, effect of irradiation of various types, 463.
growth rate, Calif. 764.
growth rate, effect of electric lights, Ind. 167.
growth variations, statistical studies, 256.
injury from cooked feeds, Wis. 463.
leg malformation in, Wis. 470.
leg weakness in, effect of acids and sugars, Wis. 462.
management in confinement, Hawaii 368.
mineral requirements, 257.
mortality, biometrical study, Calif. 256.
nutrition, deficiencies of synthetic diets, 559.
nutrition studies, Nebr. 862.
nutritive value of rations, effect of high temperatures, Wis. 462.
protein utilization by, Nebr. 862.
rearing in confinement, effect on hemoglobin, 259.
respiratory disease, new, 271.
Child—
development research, relation to parent education, 889.
health and protection, White House conference on, 888.
labor in suger beet fields of Colorado, 277.
labor on farms in Colorado, 277, 278.
Children, *see also* Infants.
in institutions, health and growth, relation to diet, 395.
malnutrition in, dietary experiment, 692.
vitamin A absorption and retention in, 295.
young, iron requirements, 290.
Chili pepper wilt, effect of soil moisture, N.Mex. 234.
Chinch bug—
as lawn pest, control, 50.
injury to lawns, Conn.State 451.
Chionaspis—
euonymi, see Euonymus scale.
pinifoliae, control, N.Y.Cornell 53.
Chlorate sprays for Johnson grass control, N.Mex. 221.
Chlorates—
for quackgrass treatment, optimum time, 685.
Chlorates—Continued.
for weed control, Mich. 729.
Chloride in milk, effect of interval between milkings, Calif. 768.
Chlorine in fertilizers, effect on cotton yield, 631.
Chlorophyll—
decomposing enzyme in orange rinds, Ala. 437.
pigment in corn, studies, 24.
Chloroplast pigments, effect of fertilizers, 25.
Chlorosis—
in rose houses, control, Mich. 745.
lime-induced, treatment, Calif. 150.
of fruit trees, aluminum sulfate for, N.Mex. 234.
2-Chlorpentane as anthelmintic, 874.
Chocolate—
ice cream, type of flavoring, 68.
pericarp color in corn, inheritance and linkage in, 521.
Cholera serum and virus, production, Ind. 174.
Cholesterol, determination, 13.
Christmas trees as cash crop, U.S.D.A. 743.
Chromosomes—
balance as factor in duration of life, 724.
nonhomologous, of corn, interchange between, 818.
number in angiosperms, 522.
number in man, 217.
of parthenoproduced Tettigidae, demonstration, 217.
structure, effect on metabolism, 725.
X and X′, in Sciara, crossing over, 425.
Chrysanthemum—
diseases, N.J. 352.
plants, effect of hardening, Mich. 641.
Chrysanthemums, shading, effect on time of blooming, Ohio 641.
Chrysomyia rufifacies, notes, 551.
Chrysopa—
californica, notes, Calif. 156.
oculata, relation to oriental peach moth, 655.
Churches, rural and urban, comparison, Mich. 785.
Cicadella circellata, studies, Calif. 53.
Cicadellidae of Brazos County, Tex. 899.
Cicadula sexnotata, see Leafhopper, six-spotted.
Cigar smoke, ammonia content, relation to tobacco fertilization, 226.
Cimex lectularius, see Bedbugs.
Cinchona ledgeriana diseases, notes, 441.
Cingilia catenaria, see Chain-spotted geometer.
Citron Fusarium wilt, notes, Fla. 440.
Citrus—
aphid, green, infestation, Fla. 451.
aphids, diseases of, studies, Fla. 438.
blast, organisms from, Calif. 743.
blight, notes, Fla. 438.
boron requirements, Calif. 722.

Citrus—Continued.
canker studies, Fla. 438.
culture in South Africa, 42.
cuttings, changes during rooting process, Calif. 722.
die-back, analyses of leaves and twigs, Fla. 438.
fertility, studies, Calif. 735.
foliage, oil retained by, determination, Ala. 450.
fruits—*see also* Lemons, Oranges, *etc.*
boron-deficient, anatomical and physiological changes in, Calif. 150.
rind marking, 649.
gummosis, treatment, 351.
hybrids, studies, Fla. 434.
hybrids, thorniness in, Calif. 723.
leaves, palisade tissue in, differences, 518.
leaves, sap concentration and inorganic constituents, Calif. 232.
mottle leaf produced by lithium, 844.
pests of Mediterranean Region, 852.
pomelo seedlings for rootstocks, Hawaii 737.
rootstocks, notes, Fla. 435.
scab control on sour orange trees, Fla. 439.
scab in Porto Rico, 150.
scab organism, development, 447.
spraying emulsions, variations, Calif. 755.
thread blight, notes, 536.
transpiration, studies, Calif. 722.
trees, bark diseases, control, Fla. 438.
Cladosporium effusum, notes, Fla. 440.
Clasterosporium carpophilum—
control in Goulburn Valley, 648.
notes, 345.
Clastoptera proteus, notes, Me. 757.
Clay pot v. other containers for seedling vegetables, Iowa 635.
Clemson College, notes, 599.
Click beetles, predatory enemies, 551.
Climate—*see also* Meteorology.
and insects, 845.
effect on nitrogen and organic matter in soil, Mo. 20.
Climates, dry, of United States, map, 315.
Climatological data, *see* Meteorological observations.
Climatology, literature of, 315.
Clostridium—
tetani spores, thermal death point, 568.
welchii spores, thermal death point, 569.
Clothes moths, paradichlorobenzene as fumigant, 457.
Clove tree, pests of, 547.
Clover—
anthracnose, fungi causing, 539.
anthracnose resistant strains, Ind. 144.
bur, digestibility, effect of exposure to sunlight and rain, Calif. 658.
bur, nutritive value, effect of leaching, Calif. 658.
Clover—Continued.
crimson, use of disk harrow for, Ga. 123.
fertilizer experiments, Ala. 429.
in rotation, effects, Colo. 717.
mite, abundance, Conn.State 451.
powdery mildew resistant varieties, Ind. 144.
red, breeding, Tenn. 825.
red, fertilizer experiments, N.C. 126.
red, improvement, N.J. 824.
red, strains for Iowa, Iowa 124.
red, variety tests, N.C. 126.
rust, notes, Ind. 144.
subterranean, rust, in West Australia, 345.
sweet, *see* Sweetclover.
varieties, behavior, N.J. 31.
variety tests, N.J. 824.
white, as honey plant, Iowa 153.
white, as honey plant, relation to pH of soil, 856.
white, fertilizer experiments, Conn. Storrs 727.
Club work, next steps in, 889.
Clubroot—
of crucifers, reaction and treatment, 236.
relation to soil alkalinity, 842.
Cobalt sulfide, controlled precipitation, 614.
Coccidae of Formosa, 248.
Coccidia—
in chickens and quail in California, 876.
of woodchucks, 353.
Coccidioidal granuloma in man and animals, 570.
Coccidioides immitis, notes, 570.
Coccidiosis—
avian, pathology, 875.
bovine, studies, Va. 774.
in lambs, 572.
in poultry, 270; Mich. 772.
in rabbits, experimental, 73.
in squirrels, relation to meningo-encephalomyelitis, 271.
studies, Calif. 770.
Coccinella septempunctata, morphology and biology, 253.
Coccinellidae, hibernation, 852.
Coccobacillus ellingeri, virulent to corn borer, 550.
Coccomyces hiemalis, control, Nebr. 837.
Coccophagus gurneyi, parasite of citrophilus mealybug, Calif. 755.
Coccophagus scutellaris, notes, 549.
Coccophagus, revision of genus, 552.
Coccospora agricola in alkaline soil, 321.
Cockerel, fattening, maintenance requirement, 65.
Cockle, corn, effect on poultry, Md. 861.
Cocklebur, sprouts, poisonous to livestock, Ind. 70.
Cockroach tissues, diamino acids in, 810.
Coconut palms—
damage from dynastid beetles, 58.
diseases, notes, 344.
fertilizer experiments, P.R. 741.

Codling moth—
 baits, chemistry of, 853.
 control, Ind. 52, 134; Iowa 135; Mich. 153; N.Mex. 227, 244.
 control in a Missouri apple district, 854.
 control in Pacific Northwest, trends, 854.
 control in South Australia, 654.
 control, preparation of treated bands for, Ind. 249.
 control, white oil sprays for, Ind. 152.
 effect of evening illumination of trees, Calif. 752.
 in Yakima Valley, Washington, 654.
 larvae, overwintering, destruction, N.J. 848.
 production, all stages throughout the winter, Calif. 752.
 spraying for, Nebr. 854.
 sprays, time for, thermal constant as indicator, 55.
 treatments, thermal constant for timing, effect of electromagnetic waves, N.J. 848.
Cod-liver meal, feeding value for poultry, N.H. 64.
Cod-liver oil—
 and good hay, similar factors in, Mich. 765.
 effect on calcium metabolism of women, Mich. 794.
 feeding, effect on calves, N.J. 865.
 feeding to young swine, 567.
 high acid, toxic properties, 258.
 spectrographic data, 804.
 toxic effects, 95.
 unsaponifiable matter, extraction, 501.
 vitamins in stored feeds, permanency, 559.
Coelaenomenodera elaeidis, notes, 246.
Coffee—
 insects affecting, 53.
 pink disease, control, 351.
 rust, notes, 344, 644.
 thread blights, control, 351.
 trees, fungus attacking, 649.
Coke, use in heating tobacco sheds, Conn.State 337.
Colaspidema atrum, notes, 651.
Cold, *see* Temperature, low.
Cold storage holdings, U.S.D.A. 784.
Colds, effect of ultra-violet irradiations, 897.
Coleophora pruniella—
 notes, Mich. 697.
 outbreak, Wis. 453.
Coleoptera—
 coprophagous, of China, list, 547.
 in America north of Mexico, 57.
 in Hunterian Collection at Glasgow, 353.
 tropisms and sense organs, 253.
Coli cultures at fever heat, effect of charcoal on pH of, 567.
Colic of horses, diagnosis, 567.
Collards, vitamins in, Ga. 194.
College graduate in industry, adjusting, 889.
College work, effect of vocational agriculture training, 487.
Colleges, *see* Agricultural colleges.
Colletotrichum and Vermicularia, identity, 535.
Colletotrichum—
 camelliae, notes, 344.
 circinans, notes, 327.
 gloeosporioides, notes, 344.
 heveae, notes, 344.
 sp., notes, 344.
 trifolii and *Gloeosporium caulivorum*, comparison, 539.
 trifolii and *Kabatiella caulivora*, comparison, 539.
Colloidal—
 behavior of soils, laws, 513.
 clays, inner layer, nature, Ala. 415.
 materials in soil profiles, character, U.S.D.A. 18.
 soils, capillary phenomena in, Hawaii 716.
Colloids—
 of Hawaiian soils, Hawaii 716.
 of honey, properties and removal, 408.
 of soil series, variations in, U.S.D.A. 18.
 soil, and bentonites, relation, Calif. 708.
 soil, characterizing, new method, 211.
Collyriclum faba, parasite of poultry, 381.
Color—
 factor in turkey breeds and crosses, 328.
 inheritance in white and yellow blossom sweetclover cross, 522.
 mutation in mice, 425.
 patterns in the grouse locust, inheritance, 217.
Colorado Station, report, 399.
Colostrum, composition and agglutinin and complement in, 665.
Colts, feeding experiments, Iowa 166.
Combine harvesting, effect of windrower, Mich. 778.
Combines—
 cost of harvesting with, Ind. 185.
 in eastern Canada, trials, Can. 825.
 prairie type, separating efficiency on cross grades, 275.
Commonwealth Fund fellowships, 500.
Communities of Schuyler County, N.Y.Cornell 786.
Communities, town-country, services of institutions and organizations, Mich. 88.
Community—*see also* Rural community.
 definition and knowledge of, 88.
 farm, and home, interrelations, 686.
Comperiella bifasciata, parasite of yellow scale in California, 549.
Comstock, J. H., editorial note, 101, 103, 107.
Concrete—
 action of sulfate water on, U.S.D.A. 575.
 and reinforced concrete, joint committee, meeting, U.S.D.A. 478.

Concrete—Continued.
construction joints in, 272.
effect of water-gas tar, U.S.D.A. 779.
flexural strength, effect of dimensions of test specimens, U.S.D.A. 478.
paving, asphalt, high-speed production, U.S.D.A. 74.
paving work, truck operation and production in, U.S.D.A. 74.
posts, wear after five years, Calif. 777.
pressure against form work, effect of vibration, U.S.D.A. 478.
reinforced, studies, 74.
tile, dense, endurance in peat soils, Wis. 477.
Coniferous seedlings, temperature of stems, measurements, Calif. 742.
Coniothecium chomatosporum, notes, 644.
Connecticut—
College, history, 888.
College, notes, 497.
State Station, notes, 497.
Station, report, 797.
Conotrachelus nenuphar, *see* Plum curculio.
Contarinia pyrivora, *see* Pear midge.
Cookery and chemistry, treatise, 392.
Cooking—
domestic, ovens used for, Ind. 196.
pans, triplicate, fuel economy, 697.
with heat generated by the resistance of food to electric current through it, Iowa 196.
Cooperation—*see also* Agricultural cooperation *and* Marketing.
and marketing, research work in England, 482.
Rochdale principles, and modern systems of credit trading, 87.
Cooperative—
marketing, elements of success in, 883.
movement in Rumania, papers on, 581.
productions, marketing, pooling, and financing, 87.
Copper—
alloys, corrosion rate in vinegar, Calif. 709.
analysis, modifications in, 92.
and iron treatment of anemia in children, 690.
carbonate for smut control, Mich. 745.
carbonate, fungicidal value, Mich. 149.
compounds for sweetpotato black rot, N.C. 147.
essential for plant growth, 516.
feeding to anemic pigs, new methods, Wis. 459.
fungicides on celery seedlings, value, N.Y.Cornell 137.
fungicides, value against cucurbit downy mildew, Fla. 439.
in foods, 690.
in hemoglobin formation, specificity, 92.
rôle in plant growth in soils of Everglades, Fla. 417.
salts as supplement to iron for anemia, Wis. 491.
Copper—Continued.
solubility in milk, Wis. 469.
sulfate medium for isolation of *Brucella abortus* from milk, 265.
sulfate, use against termites in timber, 246.
Copris minutus, notes, U.S.D.A. 181.
Corium of hoof of horses and claws of bovines, comparison, 567.
Corizoneura longirostris, bionomics and anatomy, 656.
Corms, importation into Canada, condition, 542.
Corn—
acreage survey, Iowa 125.
and cotton, rotation experiments, Ala. 428.
and hay yields, Ohio 481.
and sorghum, drought resistance, comparison, 223.
Belt, large-scale farming, social and economic aspects, 580.
billbug egg parasite, 759.
borer, European—
braconid parasite of, U.S.D.A. 252.
breeding corn for resistance to, Mich. 433, 729.
caterpillars, bacteria virulent for, 550.
control, Conn.State 451; Ind. 56.
control, husker-shredders in, U.S.D.A. 184.
control, plow coverage tests, Ind. 182.
destructive fungus disease of, 249.
effectiveness of insecticides against, 457.
epidemiology, 851, 852.
handling of single-generation larvae for parasite data, 456.
in France, 249.
in Michigan, seasonal history, 456.
infestation, relation to planting date of corn, 56; Ind. 152.
infestation, relation to vigor of plant, 454.
migration and dissemination, 456.
outbreak in Ontario, 457.
parasite and host, fats in bodies of, 253.
parasite of, U.S.D.A. 156.
population, relation to planting date of corn, 456.
situation in United States in 1930, 457.
survival and host development, correlation, 457.
survival, effects of physiological change in corn plant, 457.
breeding, Ala. 428; Fla. 429; N.C. 126; Nebr. 822; Tenn. 825.
breeding for borer resistance, Mich. 433, 729.
canned, spoilage in, identification of organisms, Fla. 488.
chlorophyll pigment in, 24.

Corn—Continued.
chocolate pericarp in, inheritance and linkage relations, 521.
composition, variations, Tex. 294.
cost of picking and cribbing, Ind. 185.
culm composition, gene affecting, Iowa 629.
culture experiments, Fla. 429; N.C. 126; Nebr. 822.
culture under dry farm conditions, N.Mex. 527; Utah 627.
dent, factor for soft starch in, 521.
Diplodia spp. affecting, Fla. 439.
double cross seed, advanced-generation hybrids as parents, 819.
double crosses, characteristics and production, Minn. 131.
ear worm—
control, Calif. 754.
external morphology, 546.
on carnation plants, 652.
studies, N.C. 153.
effect of fertilizers on protein content and feeding value, N.J. 864.
effect of potassium, Ind. 112.
evolution, 624.
feeding to two-year-old steers, 254.
fertilizer experiments, Ala. 428; Conn. Storrs 727; Fla. 429; Miss. 31; Nebr. 822; U.S.D.A. 22.
for fattening lambs, Nebr. 660.
from unlimed and limed plats, dry matter and field weight, 730.
gene for supernumerary cell divisions following meiosis, N.Y.Cornell 216.
genetic studies, 324, 624.
genetics, breeding, and improvement, bibliography, 324.
glutelins, optical rotation, 108.
gluten meal as supplement for fattening lambs, Minn. 62.
ground yellow, v. ground barley for poultry, S.C. 557.
harvesting machinery experiment, 76.
heritable characters in, 521, 818.
hybrids, characteristics, Ind. 143.
improvement, N.J. 824.
in Colorado, planting date, Colo. 34.
in South Africa, 34.
inbred strains, utilization, 819.
infecting with *Ustilago zeae*, method, Iowa 145.
infection of Basisporium dry rot, method, Iowa 145.
inheritance of resistance to *Puccinia sorghi*, 45.
insects, American, sources, Ohio 154.
lepidopterous enemies, 651.
male sterile line, cytoplasmic inheritance, 625.
meal treated with vitamin D, effect on milk, 399.
mineral deficiencies, Ind. 158.
oil, autoxidation, 309.
order of genes in, 818.
plant, ontogeny, 624.

Corn—Continued.
planting, studies, Mich. 729, 746.
production—
in Michigan, Mich. 34.
labor and power costs, Iowa 183.
on heavy plains soils, Okla.Panhandle 380.
with general-purpose tractors, 577.
ragged, a dominant character, 819.
reciprocal translocation of chromosomes, 818.
R-G linkage group in, chromosome associated with, 121.
root rot, relation to potash deficiency, N.C. 115.
rootworm, biology, N.C. 153.
rust resistance, studies, Ind. 143.
seed, Diplodia infection and treatment, effect, 747.
seed, disinfectants, relative efficiency, 235.
seed, germination, effect of disinfectants, 44.
seed treatment, Nebr. 822.
seed, unit dryer for, Mich. 778.
semidwarf type, 818.
shelled, grinding for fattening cattle, Minn. 365.
shelled, variations in local prices, Mo. 485.
silage, *see* Silage.
silklessness in, 325.
smut, notes, 441.
storage tests, Fla. 429.
stover, harvesting for industrial purposes, Iowa 183.
sweet, *see* Sweet corn.
v. oats for nursing ewes, Ind. 159.
varieties, Miss. 31.
varieties adapted to California and disease resistant, Calif. 728.
variety tests, Ala. 428; Miss. 31, 126; N.C. 126; N.Mex. 221; Nebr. 822; Tenn. 825; Utah 222; Wyo. 127.
vitamin A in, relation to yellow pigmentation, 216.
vitamin A variations in, Tex. 294.
vitamin G in, 93.
yellow dent, inheritance of white capping in, 521.
yellow, vitamin A in, Ind. 158.
yellow, vitamins B and G in, Ill. 589.
yield tests, Iowa 125.
yields, effect of weather, U.S.D.A. 617.
yields in Kansas, effect of rainfall and temperature, 510.
Cornell University, notes, 200, 499.
Cornstalk borers in France, 249.
Cornstalks, harvesting for industrial uses, Iowa 77.
Corona Oat Dust, fungicidal value, N.C. 146.
Corpora lutea—
development and vascularization, 30.
extracts, relation to pregnancy, 219.
functions, 30.

Corpora lutea—Continued.
hormone, methods of extraction, 428.
of mice, fat accumulation during the oestrous cycle, 122.
physiological studies, 219.
Correlation method, Pearson's, extension to *intraclass* and *interclass* relations, 329.
Corticium—
koleroga, studies, 536.
salmonicolor, notes, 344, 441.
sp., notes, 442.
vagum, notes, 646.
Corydalis caseana, toxicity for sheep, 177.
Coryneum beijerinckii, control in Goulburn Valley, 648.
Coryza and fowl pox, 674.
Coryza from fowl pox diphtheria, isolation, 473.
Cost of production—*see also specific crops*.
and income from crops, effect of yield. Mo. 385.
of agricultural crops in England, 385.
studies, Can. 825.
Cost studies, home economics and other fields, 889.
Cotinis nitida, *see* June beetle, green.
Cotinis texana, notes, N.Mex. 245.
Cotton—
American, outlook for, 484.
and corn, rotation experiments, Ala. 428.
and poultry farming, returns from, Ala. 480.
aphid, control, 547.
Asiatic, inheritance of corolla color and petal size, 724.
bacterial diseases, 345.
Belt, green manure crops for, U.S.D.A. 223.
blackarm disease, 646.
boll, developing, changes in composition, 631.
boll weevil, *see* Boll weevil.
bollworm, *see* Bollworm.
bolls, *Diplodia* spp. affecting, Fla. 439.
breeding, Ala. 428; Fla. 429; N.Mex. 221; Tenn. 825; V.I. 729.
Committee, Indian Central, report, 224.
cooperative marketing problems, 883.
crop, 1930, of South Carolina, grade and staple, S.C. 583.
culture experiments, N.Mex. 221.
diseases and insects affecting, Mo. 330.
diseases in Uganda, 646.
disks, dry, for milk strainers, Mich. 664.
effect of preceding crop, Miss. 31.
farm prices, relation to quality, U.S.D.A. 684.
farmers, credit problems of, Okla. 278.
farms, mechanization, 579.
fertilized, increase in labor efficiency, N.C. 131.
fertilizer experiments, Ala. 428; Fla. 429; Miss. 31, 126; Mo. 330; N.C. 131; N.Mex. 221; U.S.D.A. 22.
fertilizer formulas, Miss. 131.
Cotton—Continued.
fertilizers, time of application, Ga. 123.
fiber and seed, yield and quality, effect of soil conditions, 528.
fiber studies, N.C. 131.
fibers, staple length, effect of ginning, 825.
flowers in Egypt, natural crossing, 224.
for seed, growth fluctuations during development, 224.
genetic studies, N.Mex. 221.
genetics, breeding, and improvement, bibliography, 324.
ginned in Georgia, grade, staple length, and tenderability, Ga. 184.
ginned in three areas, quality and price, Fla. 480.
Growers' Finance Corporation, Texas, report, U.S.D.A. 682.
growth in various nutrient solutions, Ga. 123.
harvesting, development, 676.
improvement, N.C. 131.
inheritance of petal spot, 121.
inheritance of pollen and corolla color, 121.
insects, control, Fla. 455.
intercropped with yams, effect, 528.
irrigation, flood and furrow method, N.Mex. 272.
leaf worm, notes, N.Mex. 245.
lint development, factors affecting, Ala. 428.
lint percentage figures, accuracy, 631.
marketing, N.C. 188; S.C. 188.
marketing methods, U.S.D.A. 85.
metaxenia in, 423.
nitrogen sources, Ga. 123; N.C. 115.
of different varieties, lint percentage in distributed plats, 631.
organization, progress in, 585.
pests in Mongalla Province, 246.
plant, growth habits and functions of parts, U.S.D.A. 131.
plant, nitrogen in, 630.
plant, treatise, 223.
plants, fruiting behavior, effect of high soil moisture and lack of soil aeration, 825.
price-quality relationships in local markets, La. 484.
production costs, reducing, Miss. 187.
research in British Empire, 34.
research in Egypt, 528.
root rot conference at Temple, Texas, Tex. 899.
root rot, sclerotia and mycelial strands, studies, 748.
root rot, studies, Tex. 841.
seed, *see* Cottonseed.
seeding in Egypt, 224.
seedlings injury from concentrated fertilizers, N.C. 114.
seedlings, thrips affecting, S.C. 155.
spacing experiments, Ala. 428; Miss. 126; Mo. 330.
statistics, U.S.D.A. 486.

Cotton—Continued.
stem cuttings, callusing, Tex. 817.
tendering, determination, 598.
thrips, notes, 246.
varieties, Miss. 34.
varieties, blooming, 730.
varieties for hill land, Miss. 31.
variety-date of planting tests, Ga. 123.
variety tests, Ala. 428; Miss. 31, 126; Mo. 330; N.C. 131; N.Mex. 221; Tenn. 825; V.I. 729.
Verticillium wilt, notes, Tenn. 840.
wilt in Bombay, 347.
wilt resistant varieties, 45.
yields, N.Mex. 221.
yields, effect of early defloration, 331.
yields, effect of potash sources and chlorine in fertilizers, 631.

Cottonseed—
coat characters, N.C. 131.
meal—
and hulls, feeding in large amounts to cattle, effect, N.C. 158.
as supplement for fattening lambs, Minn. 62.
digestibility for range cattle, N.Mex. 255, 760.
feeding, heavy, effect on dairy cattle, 260.
feeding value, N.C. 164.
feeding value for lambs, Idaho 255.
feeding value for poultry, S.C. 556.
for pigs, 255.
injury to seedlings, 323.
poisoning, studies, N.C. 467.
oil, absorption curves of acids, 805.
pedigree, effect of seed control law, 34.
raw crushed, effect on dairy heifers, Mich. 766.
sulfuric acid treatment, results, 748.
treatment, 45; N.C. 146.
treatment, effect, Ga. 123.
treatment, value, Ga. 142.

Cottony cushion scale—
parasite, biology and post embryonic development, 251.
spread in France, 248.

Couch grass, nutritional malformation, 345.
Country, *see* Rural.
County government, contemporary, problems, 388.
Cover crop for apple orchards, Mont. 139.
Cover crops—
for pecans, Fla. 435.
for tobacco, Conn.State 335.
winter, tests, Miss. 126.
Cow manure, dehydration, 516.
Cowpea—
hay v. tepary bean hay for cattle, Okla.Panhandle 171.
roots, development of root knot nematode in, Hawaii.Pineapple Canners' 844.
rust, sex mechanism in, 445.
weevil, morphology and biology, 551.

Cowpeas sown after grain, yield, Ga. 128.
Cows—*see also* Calves, Cattle, *and* Heifers.
average ages in six breeds of cattle, 554.
blood calcium in, variations, 261.
changes in mucosa of genital tract during oestrum and pregnancy, 525.
dairy, butterfat production and feed cost, correlation, 562.
dairy, calculating rations for, 663.
dairy, utilization of nutrients, effect of nutritional plane, Vt. 561.
heavily milking, calcium and phosphorus metabolism, 260.
live weight, variations in, Iowa 169.
milk production, *see* Milk production.
milking at three eight-hour intervals, effect, 66.
pregnant and nonpregnant, acetone in blood, 567.
spraying with fly repellent, N.J. 864.
udders, *see* Udders.
Cracca virginiana, insecticidal properties, 547, 846.
Cranberries—
growing in New Jersey, N.J. 342.
studies, Mass. 339; N.J. 834.
Cranberry—
false blossom and its insect vector, 857.
false blossom, spread, U.S.D.A. 49.
insects, injurious and beneficial, Mass. 356.
insects, notes, N.J. 849.
plant, mycorrhiza on roots, N.J. 830.
products, manufacture and preservation, Mass. 394.
root grub, notes, Mass. 357.
rootworms as apple pest, 58.
Cream—
churning time, effect of pH value, 374.
deterioration, effect of air, 666; Ind. 172.
farm-skimmed, enzymes in, Ind. 172.
for butter making, marketing, Ind. 171.
layer formation on milk, N.Y.State 378.
plug, cause, Wis. 468.
production, comparative advantage of New England and Middle West, 86.
quality, judging, 865.
whipped, taint in, prevention, 68.
Creameries, cooperative work with, Iowa 172.
Creamery—
buildings, cost, Iowa 183.
license division, report, Ind. 87.
Cricket—
California tree, studies, Calif. 53.
snowy tree, injurious to raspberries, Calif. 52.
Cricket-locusts of China, 547.
Crocodile tissues, diamino acids in, 310.
Cronartium ribicola, control, 543.
Crop—
pests, minor, in Gezira, 246.
plants, fertilizer requirements, Neubauer method of determining, Ind. 112.

Crop—Continued.
plants, water requirements, 127.
reporting, 80.
reports, U.S.D.A. 189, 280, 486, 686, 784, 886.
rotations, *see* Rotation of crops.
yields, decrease, mathematical study, 526.
yields from Illinois soil experiment fields, Ill. 323.
yields, relation to seed source, Nebr. 432.
Crops—*see also* Field crops, Forage crops, Root crops, *and specific crops.*
as spring wheat substitutes, Idaho 226.
cost of production, variations in, Ohio 883.
culture in Japan, 628.
of California, State sources of statistics, Calif. 584.
preirrigation before seeding, value, Utah, 222.
production trends, U.S.D.A. 482.
utilization by pigs, N.C. 165.
variation, studies, 223.
yields, Idaho 222.
Crossing over in corn, cytological and genetical, 818.
Crotalaria—
species as cover crops, Fla. 435.
variety tests, N.C. 126.
Crown gall—
inoculation experiments, 644.
on *Rumex* sp., 43.
organism, life history, 43.
organisms, studies, Wis. 440.
situation in western Europe, 841.
transplants, studies, 43.
Crucifer black rot, notes, 345.
Crucifers, club root infection, relation to soil pH, N.J. 839.
Crude fiber, *see* Cellulose.
Cryolite, effect on bean plants, 58.
Cryptochaetum iceryae, biology and post embryonic development, 251.
Cryptolaemus, mass production, Calif. 156.
Cryptolaemus montrouzieri, notes, Calif. 156.
Cryptosporium minimum, notes, 644.
Cucumber—
beetle, belted, notes, 453.
beetle, striped, wintering habits, 458.
beetles, control, N.Y.State 149.
damping-off, combination seed and soil treatment, N.J. 838.
diseases on Long Island, studies, N.Y.State 148.
downy mildew, studies, Mass. 344.
fruit rot and angular leaf spot, relation, 45.
leaf spot and fruit rot, relation, 45.
mosaic, aphis transmission, 237.
mosaic, resistance in Chinese cucumber, 237.
mosaic, resistant strains, N.Y.State 149.
mosaic virus, transmission experiments, 248.
Cucumber—Continued.
wilt resistant strains, N.Y.State 149.
Cucumbers—
breeding, 40.
paper mulch experiments, Ohio 435.
pickling, new strain, Mich. 738.
seed decay and damping-off, control N.J. 842.
shipments, Fla. 481.
shipments from Florida and competing areas, Fla. 886.
Cucurbit—
downy mildew, control, Fla. 439; Ga. 142.
mildew, notes, 345.
Cucurbits—
chromosome numbers in, 120.
fruit shape in, determination, factorial balance in, 624.
Culex pipiens, biological races, 250.
Cultivation for sugarcane culture, 531.
Culture media, aseptic distribution, device for, Mich. 623.
Cunninghamella elegans, notes, 320.
Curculio, control, Tenn. 850.
Currant—
fruit fly, notes, 57.
rust, control, 543.
Currants—*see also* Ribes.
capsid bugs on, control, 653, 654.
lepidopterous enemy of, 550.
Cuscuta sp., notes, 345.
Cut-over lands—
in Great Lakes States, land settlement in, U.S.D.A. 278.
of northern Idaho, crops for, Idaho 222.
utilization in Lake States, 79.
Cutworm—
black, notes, 56.
brown, ecological discussion, 56.
dingy, oviposition habits, 655.
moths, light trap work with, Tenn 851.
Cutworms on blueberries, Me. 757.
Cyanophyceae, thermophily in, 120.
Cydia nigricana, notes, 246.
Cydia pomonella, *see* Codling moth.
Cymatodera aethiops, predatory enemy of codling moth, N.Mex. 245.
Cyrtorhinus mundulus, notes, 497.
Cysteine—
action of alkali on, 108.
arsenic derivatives, 201.
gasometric determination, 206.
hydrochlorides, preparation, 201.
spontaneous oxidation, 201.
thiohydantoins from, 11.
Cystine—
absorption spectrum and chemical characteristics, 201.
action of alkali on, 108.
gasometric determination, 206.
iron-free, preparation, 201.
thiohydantoins from, 11.
Dahlia cuttings, root formation and flowering, effect of length of day, 518.

Dairy—
  and milk plant equipment, paper on, 865.
  barn ventilation, Mich. 778.
  cattle and dairy cows, *see* Cattle *and* Cows.
  chemistry, recent research and discoveries, 259.
  equipment, effectiveness, Mich. 769.
  equipment, sterilization, Calif. 778.
  equipment, sterilization, symposium, 259.
  farm methods, 866.
  farming systems, treatise, 385.
  farms, organization, relation to cost of milk production, Vt. 579.
  farms, value of mechanical refrigeration, Ind. 172.
  herds, production study, Utah 679.
  industry in Australia, treatise, 864.
  industry of Germany, condition of production and marketing, 582.
  industry, outlook for, U.S.D.A. 81.
  industry, present opportunities, 866.
  marketing surveys, Wis. 482.
  produce in England and Wales, marketing, 386.
  products—
    as source of income for farm women, Nebr. 887.
    keeping quality, effect of carbonation, Ill. 373.
    processing, effect of fatty acids, N.J. 866.
    statistics, U.S.D.A. 486.
    world production and international trade in, 284.
  science, handbook, 864.
  sires, see Bulls *and* Sires.
  utensils, sterilization, 866.
Dairying—*see also* Creamery, Butter, Milk, *etc.*
  experiments in, Mass. 371.
  principles, testing and manufactures, treatise, 865.
  research work in England, 482.
Dallis grass, fertilizer experiments, Ala. 429.
Darso for fattening hogs, preparation, 255.
Dasyscypha willkommii, studies, 543.
Date—
  carbonizing dry rot, notes, Calif. 743.
  palm, Deglet Noor, decline disease, relation to nutrition and composition, Calif. 447.
  palms, decline, remedy, Calif. 722, 743.
  palms, effect of fertilizers, Calif. 735.
  peroxidase, inactivation temperature, effect of pH, 214.
Day length, effect on growth and development of plants, 120, 215.
Death camas—
  distribution of poisonous substance, Wyo. 176.
  effect on sheep, 571.
Delphinium diseases, N.J. 352.
Delphinium studies. N.Y.Cornell 641.
Dengue fever—
  transmission by yellow fever mosquito, 550.
  virus, transfer from infected to normal mosquitoes, 550.
Department of Agriculture, *see* United States Department of Agriculture.
Dermaptera of Vancouver Island, 355.
Dermatitis, infectious—
  labial, in sheep and goats, 71.
  pustular, in sheep and goats, cause, Calif. 771.
Dermatobia hominis larvae, rearing, 250.
Derris dust for carrot rust fly, Mass. 355.
Derris root, rotenone in, 50.
Desert locust, biology and control, 359.
Desmoris fulvus parasite, notes, 453.
Devil's shoestring, insecticidal properties, 547, 846.
Dew and aqueous deposits from the air, 111.
Dewberries—
  pruning, N.C. 136.
  spineless and ordinary, progeny, N.C. 136.
Dextrins, storage in seeds, Iowa 119.
Dextrose—
  in synthetic media for *Bacillus tuberculosis*, 773.
  value for preservation of eggs by freezing, 411.
Diabetes mellitus of dog and cat, postmortem findings, 567.
Diabrotica—
  balteata, *see* Cucumber beetle, belted.
  longicornis, see Corn rootworm.
  vittata, *see* Cucumber beetle, striped.
Diamalt as bait for onion maggot, Iowa 153.
Diamino acids—
  of fish, 310.
  of muscle tissue of different animals, 310.
Diammonium phosphate, effect on fire resistance of wood, 780.
Diamond-back moth, behavior, 249.
Diaphania nitidalis, *see* Pickle worm.
Diaporthe umbrina, development, 352.
Diarrhea—
  bacillary white, *see* Pullorum disease.
  infectious, in cattle, etiology, 673.
  of calves, treatment by bacteriophage, 872.
Diatraea, revision of genus, 359.
Diatraea—
  venosata, injury to sugarcane, 355.
  zeacolella, see Cornstalk borers.
Dibrachys boucheanus, parasite of codling moth. N.Mex. 245.
Dicalcium hydrogen arsenate, fungicidal properties, 537.
Dichomeris marginellus, control, N.J. 850.
Dicrocoelium dendriticum, experimental infection of sheep with, 873.
Dicyphus errans, biology, 247.
Didymellina iridis, notes, 542.
Diet—*see also* Food *and* Nutrition.
  accessory factors, *see* Vitamins.
  and nutrition therapy, textbook, 890.

Diet—Continued.
and tissue growth, 794.
4 for breeding rats for vitamin A experiments, 589.
of children, *see* Children.
of families of St. Andrews, Scotland, 290.
of infants, *see* Infants.
relation to growth and health of children in institutions, 395.
relation to reproduction and lactation, 395.
Diets—
adequate, for families of limited incomes, U.S.D.A. 192.
corrective, for anorexia in children, 593.
synthetic, for chicks, deficiencies, 559.
Digestion, effect of vitamin deficiency, 397.
Dihydrorotenone, toxicity to goldfish, 547.
Dilaudid-Knoll, papers on, 870.
Diparopsis castanea in the Sudan, summary, 359.
Diphtheria—
avian, and fowl pox, relation, 876.
calf, immunization, Wyo. 176.
Diplodia—
disease on tea, cause, 240.
ear and stalk rots of corn, Fla. 439.
seed infection of corn, effects, 747.
Diptera, Egyptian, monograph, 57.
Discomycetes, spore discharge, 442.
Diseases—
of animals, *see* Animal diseases *and specific diseases.*
of man, relation to milk supply, 865.
of plants, *see* Plant diseases *and specific host plants.*
produced and prevented by food products, 396.
Disinfectants—
coal-tar, limitations of phenol coefficients, 669.
coal-tar, variation of phenol coefficients, 669.
for sweetpotato black rot, comparison, 647.
tests for control of potato scab and black scurf, Mich. 746.
Disphaynx spiralis, developmental stages, U.S.D.A. 181.
Distemper—
antiserum of dogs, variation in potency, 472.
antiserum of dogs, properties, 270.
of dogs and hog cholera, experiments, 269.
of dogs, durability of immunity, 572.
Distomatosis of cattle, blood picture, 378.
Divarinychus floridensis n.g. and n.sp., description, 59.
Diversinervus elegans, notes, Calif. 755.
Diversinervus Silvestri, revision of genus, 552.
Dociostaurus maroccanus in Spain, dipterous parasites, 651.
Dodder, notes, 245.
Dog tick, brown—
cause of inapparent infection in man, 871, 872.
latent parasitism of *Ixodiphagus caucurtei* in, 59.
transmission of boutonneuse fever, 871.
transmission of kala azar by, 553.
Dogfish liver oil, vitamin D in, 595.
Dogs—
affections of cornea, 869, 870.
blood, arginine determination in, 12.
effect of oestrin injections, 30.
epiphysial fractures of femur, 567.
stomach content, titration and ion acidity, 868.
traumatic rupture of urinary bladder, operations for, 567.
Dolerinae of America north of Mexico, 657.
Domestic science, *see* Home economics.
Dominance—
in polymorphic species, evolution, 425.
theory of, 520.
Douglas fir—
apex, external polarity potentials in, 643.
seedlings, mulching, 342.
Drainage—
and improvement of wet land, Oreg. 575.
effect on farm machinery design and development, 575.
experiments at Baramati, report, 383.
orchard in Medford area, Oreg. 477.
problem in alkali soils, Utah 207.
tile, effect on crops, Ind. 124.
wells and ground water flow, 272.
Dramatics for farm folks, Ill. 586.
Drought—
of 1930, effect on insect population, 845.
of 1930 in West Virginia, 808.
resistance of plants, nature, 120.
Drugs—
analyses, Conn.State 789.
and chemicals, analysis, treatise, 314.
Drug-store weevil—
attack of herbarium plants by, 852.
notes, 246.
Duck kidney grafts on chick embryos, species specificity study, 218.
Ducks—
and botulism, 271.
host of spirurids, U.S.D.A. 182.
wild, of North Dakota lakes, food plants of, U.S.D.A. 151.
Dust treatments, new, for smuts of oats, 235.
Dusting, *see* Spraying *and specific crops.*
Dyes—
and gelatin granules, mode of combination, 9.
combination with nucleic acid or gelatin, stoichiometrical relations, 202.
Dysentery, chronic bacterial, *see* Johne's *disease.*
Earth roads, oil-treated, in Missouri, U.S.D.A. 875.

Earths, rare, neoformations in roots, 26.
Eccoptogaster (*Scolytus*) *quadrispinosus*, *see* Hickory bark beetle.
Economic—
biological problems, principles useful in solving, 546.
changes in Japan since World War, 586.
information, reaching farmers with, 889.
periodicals of foreign countries published in English, list, U.S.D.A. 185.
relationships and social conflict, Mich. 486.
research and theory of probability, 79.
research, application to village in Bengal, 79.
theory and natural science point of view, 479.
Economics, agricultural and rural, *see* Agricultural *and* Rural economics.
Ectoparasites, combat for possession of host, 552.
Edema, malignant, immunity to, 871.
Education—
adult, part of home economics in, 889.
agricultural, *see* Agricultural education.
for home and family life, 90.
National Advisory Committee, recommendations, 888.
public, cost of in Larimer County, Colo. 82.
vocational, *see* Vocational education.
Edwards, H., memorial to, 888.
Egg—
albumin, *see* Albumin, egg.
industry, statistics and charts, U.S.D.A. 84.
laying, effect of ovarian injury, 524.
production—*see also* Hens, laying.
breeding for, Iowa, 168; Mass. 368.
cost, effect of source of protein, N.C. 168.
feeding for, Iowa 662.
in fowls, effect of bodily injury, 220.
maintaining through periods of severe cold, use of heat for, Mich. 778.
relation to temperature, Okla.Panhandle 464.
winter, effect of all-night lights, Ohio 560.
yolk, desoxycholic acid compound of vitamin A from, 501.
Eggplant—
fruit rot, control, N.J. 838.
wilt, studies, Mass. 343; N.J. 838.
Eggplants—
abortion and intersexual flowers in, 738.
car-lot shipments from Florida and competing areas, Fla. 886.
shipments, Fla. 481.
Eggplants—Continued.
shipments to New York City, returns from, V.I. 737.
Eggs—
cold storage holdings, U.S.D.A. 784.
cost and efficiency in production, Oreg. 885.
cost of production, factors in, 465.
developing, embryological biochemistry, 524.
feed purchasing power, Pa. 279.
fresh first, price at New York, 1919–1928, 84.
grading on the farm, N.J. 465.
in ice cream, effect, 68.
incubation, *see* Incubation.
infected with *Salmonella pullorum*, 382.
infertile, as source of protein for baby chicks, Wis. 462.
Mississippi, storage test, Miss. 65.
preservation by freezing, merits of sucrose, dextrose, and levulose in, 411.
quality studies, Calif. 763.
stored in carbon dioxide, effect, Calif. 764.
variation in, causes, 524.
variations in local prices, Mo. 485.
weight, factors affecting, 523.
whipping and coagulation, 891.
year's weight records, N.J. 863.
Egyptianella pullorum—*see also* *Aegyptianella pullorum*.
notes, 475, 877.
Eimeria—
bukidnonensis n.sp. from cattle, 266.
faurei, notes, 572.
os n.sp., notes, 353.
perforoides n.sp., notes, 353.
sanguinaria, studies, N.C. 180.
sciurorum of squirrels, relation to meningo-encephalomyelitis, 271.
spp. in chickens and quail in California, 876.
spp., notes, 875; Va. 774.
spp. of woodchucks, 353.
Elaioplasts, nature and functions, 119.
Elasmus flabellatus, notes, 552.
Elateridae, predatory enemies, 551.
Electric—
hotbeds, development and use, 576.
lights, effect on chick growth, Ind. 167.
motor for pumping water, selecting, Mich. 697.
motors for ventilation of dairy barns, Iowa 183.
plants, wind-driven, studies, Nebr. 878.
ranges, surface units in, thermal efficiency, 697.
stoves, ovens of, Ind. 196.
wiring for the farm, 575, 576.
Electricity—
for heating hotbeds, operating costs, Mo. 881.
in agriculture, research on, survey, 676.

Electricity—Continued.
in cooking, apparatus for, Iowa 196.
on farms, 889.
on Nebraska farms, Nebr. 575, 878.
on Virginia farms, 676.
use in incubators designed for kerosene, Mich. 479.
use in threshing, studies, Ind. 183.
Elevators, farmers', of Ohio, financial operations, 386.
Elm—
bark beetle, nematode infesting, 551.
disease, Dutch, in Ohio, 543; Ohio 448.
disease, studies, 352.
leaf beetle infestations, effect of climatic conditions, 454.
scale, European, control, 456.
wood, structure, relation to properties, 233.
Elymus canadensis as host for Hessian fly, 457.
Embryology and genetics, scientific concepts, 623.
Embryos—
of cattle, development of pigment in, 524.
of fowls, variation, causes, 524.
Emphysema, subcutaneous, in operated and unoperated fowl, 381.
Empoasca—
fabae, control, Conn.State 451.
fabae on legumes, injury, 44.
fabae, oviposition and nymphal development on different hosts, 455.
mali, *see* Apple leafhoppers *and* Potato leafhopper.
spp., American, north of Mexico, revision, U.S.D.A. 54.
spp., distribution, 455.
Empusa fresenii, notes, Fla. 438.
Encarsia formosa, parasite of greenhouse white fly, 361.
Encephalitis of foxes, filtrable virus, relation to streptococci, 271.
Encephalomyelitis of sheep and cattle, experimental enzootic, 269.
Engineering—
agricultural—
events relating to, editorial, 401.
opportunities for, research in Southeastern States, 574.
research and engineering experiment stations, 889.
experiment station legislation, status, 889.
graduates, placement, 889.
research in agriculture, opportunities for, editorial, 1.
Engines—
gas and gasoline, *see* Engines, internal-combustion.
internal-combustion—
combustion process in, 274.
effect of turbulence on compression ratio, 383.
Engytatus geniculatus, notes, 50.
Enteritis—
chronic, *see* Johne's disease.
necrotic, relation to nutrition, 255.
of sheep, cause, 472.
vibrionic, in calves, 673.
Enterobius vermicularis in man, control, Mich. 772.
Enterohepatitis, infectious, *see* Blackhead.
Entomological—
Conference, Third Imperial, report, 853.
research at Camberra, 547.
Society of British Columbia, proceedings, 355.
work, early, in Connecticut, Conn.State 451.
work of Berber Field Laboratory, 246.
work of Talodi Field Laboratory, 246.
Entomology—*see also* Insects.
agricultural, textbook, 545.
for sugar planter, 246.
Indian, list of publications, 547.
Montana State Board, report, 546.
papers at Fourth Pacific Science Congress, 756.
recent advances in, treatise, 353.
relation to public health, 244.
Environment and heredity, interdependence, 520.
Enzymes—
in sweet and sour farm-skimmed cream, Ind. 172.
of tobacco, studies, 712.
proteolytic, effect on urease preparations, 712.
purification, 11.
Ephestia kuehniella, *see* Flour moth, Mediterranean.
Epilachna corrupta, *see* Bean beetle, Mexican.
Epithelioma contagiosa, transmission by mosquitoes, 250.
Epitrix cucumeris, *see* Potato flea beetle.
Epochra canadensis, *see* Currant fruit fly.
Ergosterol—
activation with radium emanation, 806.
deficient diet, calcification of bones of rats on, 895.
imperfectly ozonized, and vitamin D, 205.
irradiated—*see also* Viosterol.
and calcium-free diet, 95.
effect on calcium-phosphorus metabolism, 558.
overdosage, effect on fowls, 96.
stability, 614.
Eriosoma n.sp. on pear roots, 851.
Erodium botrys, nutritive value, effect of leaching, Calif. 658.
Erysiphaceae conidia, germination, 442.
Erysiphe cichoracearum, notes, 845.
Erysiphe polygoni conidia, germination, 442.
Erythroneura—
lubiae n.sp., description, 359.
plena, notes, 453.

Escherichia coli—
effect of hydrogen peroxide, Wis. 471.
notes, Mich. 175.
Ethylene gas for ripening tomatoes, 534.
Etiella zinckenella, notes, 457.
Eucleodora cocae n.sp., description, 655.
Eucomys swederi, notes, 549.
Eulecanium coryli affecting fruit and shade trees, 654.
Euonymus scale, notes, 851.
Eupelmus sp., notes, Calif. 53.
Eupleura caudata, trapping, N.J. 243.
Euproctis chrysorrhoea, *see* Brown-tail moth.
Eupteromalus nidulans, biology and habits, 758.
Eurygaster integriceps, epidemiology, 852.
Euscelis and allied genera, keys, 247.
Euscelis striatulus, transmission of cranberry false blossom by, 358; U.S.D.A. 49.
Eutettix tenella, *see* Beet leafhopper.
Euxoa radians, ecological discussion, 56.
Euzora sp. ? and enemies, 546.
Evergreens, winter injury, N.J. 352.
Evolution—
emergent, 520.
habit the driving factor in, 725.
in Mendelian population, 324.
Ewes—*see also* Sheep.
breeding, wintering, Oreg. 160.
fine wool, size, relation to production, Mont. 554.
North Carolina, upgrading, 254.
nursing, oats v. corn for, Ind. 159.
range, concentrates in rations, Mont. 761.
Exanthematous fever—
inapparent in man, 871.
transmission studies, 871.
virus, hibernation, 872.
Excretion in plants, 120.
Exeristes roborator, oil of, 253.
Exochomus quadripustulatus, notes, 549.
Exosporium palmivorum, notes, 344.
Experiment station Swedish Central, history and work, 198.
Experiment stations—*see also* Alabama, Arkansas, *etc.*
in 1930, editorial, 702.
organization list, U.S.D.A. 190.
report, 796.
Extension—
agencies, relation to readjustment of agriculture, 888.
effect of economic trends, 888.
program for soil erosion control work, 320.
program, standards of living as basis, 888.
work, cooperative, 1929, U.S.D.A. 488.
work in cooperative marketing, U.S.D.A. 190.
Fabrics, piled or napped, measuring thickness, 696.
Families—*see also* Farm families.
of St. Andrews, Scotland, diet of, 290.
Family relationships, paper on, 889.
Family, size of, and sex ratio, 526.
Farm—
accounting—
data, national value, 80.
paper on, 581.
place in extension, 579.
place in research, 579.
accounts, results, 80.
animals, *see* Livestock *and* Animals.
budget, 580.
buildings, bracing, U.S.D.A. 881.
buildings, construction, handbook, 384.
business—
administration, introduction to theory, treatise, 579.
in Saskatchewan, 680.
planning, N.C. 782.
records, R.I. 579.
statistics, U.S.D.A. 486.
survey of early potato section, Va. 483.
construction, use of logs and poles, U.S.D.A. 479.
credit, *see* Agricultural credit.
crops teaching, recent changes in, 888.
efficiency factors, interpretation, 276.
families—*see also* Families.
cash expenditures, Ohio 285.
equipment for communication and household convenience, 391.
finances, N.Y.Cornell 795.
goods and services used by, Wis. 481.
of Iowa, consumption habits and standards, Iowa 196.
of Vermont, food consumption, Vt. 688.
participation in activities of organizations and of schools, 391.
sociological case study, 687.
home, and community, interrelations, 686.
labor, *see* Agricultural labor.
life in Arkansas Valley of Colorado, 278.
machinery, *see* Agricultural machinery.
management—
advisory work, 80.
and incomes, Ark. 678.
and outlook information for extension use, 276.
business surveys, tables, N.J. 882.
data of Great Britain, application in United States, 580.
extension, discussion, 580.
extension programs, coordination, 580.
in Russia, 80.
opportunities and responsibilities, 579.
Piedmont, for 1931, S.C. 187.
research in northeastern States, results, 80.
research seminar, 580.
service, development, 276.
studies, 581; S.C. 80.

Farm—Continued.
mortgages, foreclosures, factors affecting, 80.
organization—
and management, improvement, budget method, Ky. 278.
for extension work, 889.
in Canada, results of post-war depression, 78, 81.
organizations, success or failure, factors in, 889.
ownership in high tenancy region, steps in, 390.
ownership in low tenancy region, post-ownership steps, 389.
prices, index numbers, Iowa 185.
problems and possible solutions, 581.
products, *see* Agricultural products.
property in New York State, long-term mortgage loans on, 682.
real estate—
situation, U.S.D.A. 82.
valuation for taxation, 79.
value, factors affecting, 80.
values in Ohio, index, 389.
taxation, *see* Taxation.
trade centers in Minnesota, 1905–29, Minn. 86.
wages and wage regulation in England and Wales, 79.
youth, organizations affecting, 686; Pa. 887.
Farmers—
foreign-born, and their children, 686.
indebtedness in Germany, increase and credit control, 80.
master, of America and their education, 89.
of Oklahoma, mobility, economic and social aspects, Okla. 285.
Farming—*see also* Agriculture.
areas in Texas, type, Tex. 678.
dairy, *see* Dairy farming.
dry-land, system, N.Mex. 187, 527.
general irrigated, outlook, 580.
in Canada, types, 80.
in northwest Florida, Fla. 480.
in United States, types, 80.
large-scale, in Corn Belt, social and economic aspects, 580.
large-scale, in Wheat Belt, social and economic aspects, 579.
occupations in Connecticut, genesis, 686.
on terraced land, need of improved machinery, 274.
poultry and cotton, returns from, Ala. 480.
readjustments in wheat district of Washington and Idaho, 580.
survey, 79.
systems in western Montana, development, Mont. 187.
technical revolution in and agricultural depression, 276.
Farms—
as basis of advisory work, economic classification, 80.
electricity on, *see* Electricity.
hours of labor on, Wis. 482.
in Michigan, decrease in number, Mich. 686.
irrigated, of northern Colorado, program for, 386.
of Ohio, average day's work, 389.
of Ohio, size, Ohio 678.
profits, relation to size and other factors, Mich. 782.
Soviet State, and specialization in agriculture, 80.
Fat losses in buttermilk, Minn. 173.
Fats—*see also* Oils.
antioxidants and autoxidation, 205.
spectrographic data, 805.
Fatty acids—
and their triglycerides, effect on processing of dairy products, N.J. 866.
in blood plasma of dry and milking cows, 261.
solid, studies, 409.
spectrographic data, 805.
Feces of horses, reaction, 870.
Federal Farm Board—
activities, 482, 580.
activities, questions and answers concerning, 83.
and livestock producers, 253.
papers on, 585, 888.
price stabilization under, 279.
program, 580.
relation to cooperative marketing, 79.
Federisch integer, reliability and value, 567.
Feeding experiments—*see also* Cows, Pigs, *etc.*
methods, 253.
Feeding stuffs—
for fattening range calves, Ariz. 60.
grinder, description, 677.
grinding, value, Minn. 365.
in England and Wales during 1930, 662.
inspection and analyses, Conn.State 255; Ind. 659; Mass. 60; N.J. 857; R.I. 553; Vt. 553.
inspection, history, Vt. 553.
mixed, estimation of salt and molasses in, Tex. 615.
preparation for colts, Iowa 166.
Feltia subgothica, *see* Dingy cutworm.
Fence posts, service records, 780.
Fence wire, preventing corrosion, 273.
Fencing materials, studies, Calif. 777.
Fenusa pumila, life history and control, 59.
Fermentations—
in food industries, 411.
minor industrial, 411.
Ferns, control in New Zealand, 583.

Ferric—*see also* Iron.
oxide, hydrated, as sticker and corrective for arsenical injury, 847.
Fertilizer—
experiments—*see also special crops.*
Can. 825; Fla. 416; Ind. 112, 113; N.C. 115, 116; Utah 207; Wis. 421.
cooperative, Nebr. 810; Nev. 720.
field and cylinder, N.J. 810.
general, fiftieth anniversary, Pa. 815.
interpreting and presenting results, 517.
of several soil types, N.Y.Cornell 621.
requirements of crops, N.C. 118.
requirements of crops, Neubauer method of determining, Ind. 112.
requirements of soils, *see* Soils.
Fertilizers—
analyses, Vt. 516.
and manures, efficiency, R.I. 511.
calcium ratios in, N.C. 114.
commercial, for cotton, Miss. 131.
composition and cost, N.Y.State 323.
control work, history, Vt. 516.
distribution method for fruit trees, 421.
inspection and analyses, Mass. 22; Mo. 422; N.J. 23; R.I. 816.
mineral, effect on *Nicotiana rustica,* 632.
nitrogenous, *see* Nitrogenous fertilizers.
on tobacco, effect on cigar leaf, 226.
registrations, N.J. 23.
Feterita, prolamins of, 10.
Fiber, crude, *see* Cellulose.
Fidia viticida, see Grape rootworm.
Field crops—*see also* Crops, Forage crops, Root crops, *etc.*
tillage and cultural experiments, Can. 825.
Field experiments—
plat arrangement and sampling, Hawaii.Pineapple Canners' 626.
standardization, report, 526.
under dry farm conditions, Utah 627.
with Illinois soils, yields, Ill. 323.
yield of missing plat in, estimating, 221.
Fig—
decay due to insects, Calif. 744.
insects in California, U.S.D.A. 357.
peroxidase, inactivation temperature, effect of pH, 214.
Figs—
Calimyrna, insect and mold injury, control, Calif. 755.
production and diseases, Calif. 351.
varietal and cultural notes, Fla. 485.
Fire blight—
resistance of pomaceous fruits, 350.
resistant fruits, breeding, Tenn. 840.
situation, Tenn. 150.
situation in Ontario, 540.
Fire losses to farm buildings, prevention, Iowa 677.
Fires, rural, fighting, tests of hose for, N.J. 578.
Fire-weather service, 415.
Fish—
cold storage holdings, U.S.D.A. 784.
diamino acid nitrogen in flesh muscles, 310.
liver oils, toxic effect, 95.
liver oils, unsaponifiable matter, extraction, 501.
meal, feeding value, Iowa 168; N.J. 865; Vt. 561.
oils, vitamins A and D in, 397.
poisoning and insecticidal plants, U.S.D.A. 846.
Fitweed—
poisonous to livestock, Nev. 668.
toxicity for sheep, 177.
Five-year plan of Soviet Union, treatise, 386.
Flavone, identity and naming, 216.
Flax—
effect of fertilizers on growth and oil content, 529.
experiments, Can. 825.
fertilizer experiments, 529.
fiber, time for harvest, U.S.D.A. 224.
genetics of, 825.
Indian, inheritance of characters in, 817.
rust, studies, 347.
variety tests, N.J. 824.
water requirements, 128.
Flaxseed and safflower seed, oil content, Wyo. 127.
Flea beetle, southern, on tobacco, control, Conn.State 356.
Flea beetles—
as vectors of potato diseases, Nebr. 348.
control, N.J. 838.
parasites of, 552.
Fleas—
hatching of eggs, 244.
transmission of typhus fever by, 657.
Flies—
exposed to pyrethrum sprays, reproductivity, 453.
house, *see* House flies.
muscoid, in Iowa, wintering habits, 250.
white, *see* White fly.
Flood—
control reservoir sites, field examinations of, 272.
irrigation, 879.
Flora—*see also* Plants.
in central Kansas, factors affecting, 422.
thermal, origin, 120.
Florida Station, report, 496.
Flour—*see also* Bread.
from Wyoming hard wheat, baking qualities, Wyo. 191.
international trade, statistics, 886.
mixtures, baking at high altitudes, Colo. 90, 91.

Flour—Continued.
moth, Mediterranean, growth and development, 248.
overgrinding, effect on keeping quality of bread, 890.
self-rising, stability of leavening in, 890.
starch in, determination, 13.
variations in local prices, Mo. 485.
wheat, export trade of United States, 582.
Flowers—*see also* Plants, ornamental.
carbon dioxide storage, 412.
Flume design, experiments with flumed regulator, 675.
Fluorine feeding, effect on dairy cattle, Mich. 766.
Fluosilicates, incompatibility with lime, 51.
Fly larvae in snuff, 852.
Fly repellents, effect on milk production, N.C. 171.
Fodder crops, *see* Forage crops.
Fomes lignosus, notes, 537.
Food—*see also* Diet.
allergy, treatise, 890.
chemistry and nutrition, treatise, 392.
constituents, diseases produced and prevented by, 396.
consumption of Vermont farm households, Vt. 688.
industries, fermentation processes in, 411.
prices, relation to quality, 86.
requirements for growth of rats, 690.
Foods—
analyses, Conn.State 789.
canned, *see* Canned foods.
copper in, 690.
vitamins in, Ga. 192.
Foot-and-mouth disease—
control, pus and pus removal in, 869.
disinfectants, tests, 868.
importance of dung disposal, 869.
infectivity of urine, feces, bile, and milk in, 868.
Forage—
crops—
and pigs, 662.
effect of windbreaks, Wyo. 127.
for hogs, Nebr. 860.
variety tests, Nebr. 822.
yields, Calif. 727.
farm grinding, value, 677.
grasses, culture, Hawaii 730.
grasses, variety tests, Wyo. 127.
mixtures for hay and pasture, tests, Wyo. 127.
plants, chemistry, Wyo. 160.
plants, native, from eastern swampy part of State, N.C. 158.
plants, nutritive value, effect of leaching, Calif. 658.
poisoning, *see* Livestock poisoning, Plants, poisonous, *and specific plants*.
preferences of livestock, determination, 856.
Forest—
administration, *see* Forestry.
News of Ohio, Ohio 437, 644.
plantation in quack grass, Mich. 437
plantations, thinning, effect, Mich. 437
products, handling and marketing, Va 42.
property and other real estate, assessment ratios, U.S.D.A. 186.
protection and logging slash, Wis. 644
rangers' catechism, U.S.D.A. 743.
slash disposal, Wis. 437.
soil humus, carbon-organic matter factor in, 814.
tax laws, State digest, U.S.D.A. 343
trees, *see* Trees.
vegetation, rôle in soil erosion and run-off, 575.
Forestry—
statistics, mathematical theory of elements, treatise, 678.
studies, Calif. 742; Mich. 742.
Forests—
national, and forest areas in Utah U.S.D.A. 141.
of Vermont, natural reproduction in Vt. 436.
Formaldehyde—
for disinfection of foulbrood combs 252.
fungicidal value, Mich. 149, 745.
Formic acid, dissociation constants, evaluation, 611.
Foulbrood combs, disinfection with formaldehyde, 252.
4-H club work—
educational values, U.S.D.A. 687.
in animal husbandry, effect of Smith-Hughes teaching, 255.
in Virginia, Va. 391.
in West Virginia, W.Va. 287.
Fowl—
cholera—
disinfectants, tests, 868.
epidemiological studies, N.J. 874.
rare form in Hungary, 573.
transmission through the air, 876.
diphtheria, immunization, 567.
mite, northern, notes, 757.
paralysis, *see* Paralysis.
pest, disinfection experiments, 567.
pest, Madras, studies, 573.
plague, immunization experiments, N.J 874.
plague virus, atypical, from Egypt, 473
pox—
and avian diphtheria, relation, 876.
and coryza, 674.
bodies, notes, 870.
diphtheria, coryza from, isolation, 473.
immunization, 381, 567.
in baby chicks, Hawaii, 776.
inclusions and molluscum bodies, comparison, 270.
ansmission by mosquitoes, 876.

Fowl—Continued.
pox—continued.
use of vaccine for, Mich. 772.
vaccines, studies, R.I. 573.
virus, recovery from vaccines by cataphoresis, 877.
virus, susceptibility of embryonic chick tissue, 876.
typhoid—
in chicks, use of disinfectants, R.I. 572.
in turkeys, transmission by chickens, Calif. 770.
studies, N.C. 179.
Fowls—*see also* Chickens, Hens, Poultry, *etc.*
activities in laying house, 464.
artificial insemination of, results, 27.
autopsies, N.J. 478.
Collyriclum cysts in, 381.
comb and crest characters, 27.
effect of excess irradiated ergosterol, 96.
effect of female hormone, 28.
feather growth and character, effect of thyroid, 626.
frizzle character in, 523.
inheritance of body weight in, R.I. 820.
inheritance of creeper traits in, 425.
molting, effect of thallium salts, 764.
ovariotomized, implantation of juvenile testicular tissue into, 28.
ovariotomized, male characteristics in, 218.
pathological conditions in ceca, 875.
surface area, determination, 65.
Fox, male genital apparatus, 217.
Foxtail—
meadow, protein content, effect of cutting, 33.
slender, eradication, 226.
Frames, continuous, elastic analysis by column analogy, 272.
Frankliniella—
fusca, life history and control, S.C. 155.
vaccinii, notes, Me. 757.
Frit fly, nematode parasite of, 360.
Frogs as predators of wireworms or click beetles, 551.
Frost formation and air drainage, 808.
Frost penetration, 617.
Frosts, forecasting in melon growing region of Oregon, U.S.D.A. 808.
Fruit—
diseases, control, Mich. 745.
diseases in Prussia, 535.
diseases, studies, 834.
flies, notes, 246.
flies of New York, 56.
fly, Mediterranean—
control experiments with glass bait traps, 651.
probable distribution in United States, 250.
industry of British Columbia, report, 886.
Fruit—Continued.
jellies, rôle of pectin in, Del. 407.
moth, oriental, *see* Peach moth, oriental.
oxidase activity, factors affecting, 214.
oxidase, inactivation temperature, effect of pH, 214.
packing equipment for New South Wales, 881.
production, effect of spring freezes, N.Mex. 227.
setting in pecans, 232.
stock production, seedlings for, Tenn. 830.
thinning, residual effects, Mich. 639.
tree leaf roller, control, 854.
tree leaf roller, major enemy of apples and pears, Mich. 756.
tree little leaf, control, Calif. 735.
trees—
delayed foliation, Calif. 744.
fertilizer experiments, 638.
injury from cold, 26.
of South Africa, pollination requirements, 40.
planting and care, Wyo. 739.
pollen quality, 26.
pollination experiments, 636.
young, fruit setting, Ind. 133.
Fruits—*see also* Orchards, Apples, Peaches, *etc.*
air-cooled v. iced storage room for, Ind. 135.
canned, determining tenderness, apparatus, U.S.D.A. 190.
carbon dioxide, storage, 412.
citrus, *see* Citrus.
cold-pack, storage holdings, U.S.D.A. 784.
dried, moisture determination, Calif. 709.
frozen pack, temperature changes during freezing and thawing, Calif. 788.
frozen, use in ice cream, Mass. 394.
growth studies, 215, 227.
inspection work, Ind. 134.
of Florida, tropical and subtropical, Fla. 232.
preservation by freezing, Ga. 191.
receipts at 15 Pennsylvania cities, 84.
research work in England, 482.
small—
blooming data, N.J. 833.
frozen pack method of preserving, Oreg. 788.
industry in Oregon, 282.
irrigation for, Oreg. 740.
production, Ga. 139.
variety tests, N.Mex. 227.
statistics, U.S.D.A. 486.
stone, diseases affecting, 345.
storage in air containing acetaldehyde, 232.
tests, Hawaii 737; Tenn. 830.
Fuels—
antiknock values, action of oils on, 76.
motor, knock rating, 675.

Fumigation methods, research in, Fla. 454.
Fundella cistipennis, notes, 457.
Fungi—
blackroot, in Hevea, 649.
pathogenic, physiologic specialization in, 442.
spore discharge, 442.
tropical root disease, nomenclature, 537.
variation in, 522.
Fungicides—*see also* Sprays *and specific kinds.*
analyses, Me. 137; N.J. 40.
Fungus flora of soils, 320.
Fur-bearing animals—
of Alaska, laws and regulations, U.S.D.A. 151.
parasites and parasitic diseases, 271.
Furfural penetration in plant tissues, 519.
Furniture slip covers, selection, U.S.D.A. 696.
Fusarium—
batatatis, notes, N.C. 147.
cepae, description, 237.
conglutinans callistephi on aster seed, N.Y.State 741.
conglutinans callistephi, studies, 541.
lycopersici ?, notes, 344.
lycopersici, studies, N.C. 146.
moniliforme fici, notes, Calif. 351.
moniliforme, notes, 441.
niveum on watermelon, 239, 240.
sp., notes, 344, 345, 441.
spp., notes, 347.
spp. on rye in Germany, 537.
vasinfectum, notes, 347, 441, 646.
vasinfectum tracheiphilum, notes, Calif. 744.
Fusarium—
biochemistry, 566.
in soil flora, 320.
specimens in herbarium of Bureau of Plant Industry, 537.
wilt resistance in peas, Wis. 446.
Fusi spirochaeta caeci-gallorum n.sp., description, 73.
Fusicladium dendriticum, *see* Apple scab.
Fusicladium saliciperdum, notes, 544.
Galerucella—
luteola, *see* Elm leaf beetle.
vaccinii, notes, Me. 757.
Gall midges of Orient, 546.
Galleria mellonella, *see* Wax moth.
Galls, Tetraneura and Schizoneura, histogenetic and biological studies, 548.
Game of Alaska, laws and regulations, U.S.D.A. 151.
Garden Club of America, Honorary Award Medal, 800.
Garden insects, notes, N.Mex. 245.
Gardening, dictionary, 227.
Garget, detection, 259.
Garlic, three-cornered, new noxious weed, 533.
Gas engines, *see* Engines, internal-combustion.
Gas grain treater for smut control, 880.
Gas pressure in oak trees, 423.
Gasoline, production by hydrogenation, 2
Gelatin—
and dye, stoichiometrical relatio 202.
granules and dyes, mode of combir tion, 9.
use in ice cream, Mass. 372.
Gelechia gossypiella, *see* Bollworm, pink.
Gene structure, side-chain theory, 324.
Genes in corn, loci for, 818.
Genetics and embryology, scientific cc cepts, 623.
Geology of Sandoval County, New Mexi 778.
Georgia Mountain Experiment Statio notes, 899.
Georgia Station, report, 197.
Geranium, *Diplodia* spp. affecting, Fla. 4
Germ cells—
of mammals, formation, 725.
origin, 30.
Germicides, phenol coefficient tests of tivity, limitations, 377.
Gestation, determination methods, 869.
Gezira Laboratory, activities during 19 246.
Gibberella saubinetii, notes, Wis. 441.
Gipsy moth—
control, Conn.State 451.
isolated colonies, eradicating, 456.
larvae, physiological reaction by, 4
male, attractants for, 453.
Gladiolus—
corms, soaking in disinfectants, sults, N.J. 839.
corms, storage and forcing by supp mental light, Mass, 339.
corms, storage rot of, 542.
diseases, 542; Mich. 745; N.J. 352.
varieties, sugar content and nect yield, Iowa 153.
Glass substitutes, effect on rickets in gro ing chicks, 258.
Globulin, crystalline, in banana seeds,
Gloeosporium—
caulivorum and *Colletotrichum trifol* comparison, 539.
musarum, notes, 344.
Glutathione—
behavior in yeast, 310.
structure, 11.
studies, 610.
Glutelins, studies, 108.
Glycine from cells without liquid junctio acid and base constants, 609.
Glycogen extraction from fresh rabl livers, 202.
Glypta rufiscutellaris, notes, N.J. 54.
Gnorimoschema tuberosella n.sp., descri tion, 655.
Goats—
nervous condition, 426.
poisoning with laurel, U.S.D.A. 177.
scabby mouth of, 71.
Goatsuckers of New Jersey, N.J. 448.

Goldenrod, western, poisonous to sheep and cattle, Nev. 772.
Gonad, compensatory right, of hen, development, 524.
Gonads and pituitary body, relation, 29.
Gongylonema ingluvicola, notes, U.S.D.A. 181.
Goniobasis plicifera var. *silicula*, notes, 72.
Gophers—
 pocket, habits and status, U.S.D.A. 49.
 susceptibility to *Mycobacterium tuberculosis*, 570.
Gossyparia ulmi, control, 456.
Gossypol in cottonseed, variation during growth, 631.
Grafting, study of water movement in relation to, Oreg. 738.
Grain—
 bug, epidemiology, 852.
 bulk and sack handling in Pacific Coast States, U.S.D.A. 281.
 bulk handling from hillside type combine, Idaho 281.
 cooperative associations, organization under Capper-Volstead Act, 387.
 Corporation, Farmers National, marketing work, 585.
 diseases, control, Calif. 345.
 drying, tests, Ind. 183.
 farm grinding, value, 677.
 feeding as supplement to Wyoming native hay, Wyo. 766.
 feeding to lambs for spring market, Ala. 460.
 futures, hedging in, U.S.D.A. 684.
 grinding, effect, Idaho 255.
 growing, world, prices and trends, 387.
 harvester, new type, tests, 275.
 harvesting, harvester-stacker method, N.Dak. 184.
 imports, European, recent developments, 80.
 marketing, cooperative, in Canada and United States, 79.
 marketing organizations, new regional, 585.
 preparation for pigs, Oreg. 861.
 ration, make-up, bulk as factor, Mich. 765.
 stored, protection from insects by use of oils, 454.
 value for heifers, Wyo. 171.
Grains—*see also* Cereals *and* Oats, Rye, Wheat, *etc.*
 acreage survey, Iowa 125.
 effect of windbreaks, Wyo. 127.
 for cut-over lands, Idaho 222.
 for pork production, Wyo. 166.
 small, height of stubble and straw yields, 33.
 statistics, U.S.D.A. 486.
Gram Mystrosporium blight, notes, 441.
Grama grass seed, machine for harvesting, N.Mex. 221.
Gramineae, growth and yield, effect of reduction of photosynthetic tissue, Calif. 128.
Granuloma, coccidioidal, in cattle, Calif. 770.
Grape—
 black rot, control, Nebr. 837.
 diseases, notes, 345.
 juice, chemistry, N.Y.State 807.
 juice, cream of tartar in, effect of potassium tartrate, Calif. 709.
 juice, enzymic clarification, N.Y.State 712.
 leafhoppers of Maculata group, 654.
 mealybug, biological control, Calif. 156.
 phylloxera in eastern Europe, 852.
 rootworm, notes, Mich. 153.
 seedlings, development, Calif. 736.
 sirups and concentrates, darkening, cause, Calif. 709.
Grapefruit—
 abscission following prolonged rains, Calif. 743.
 boron-deficient, anatomical and physiological changes in, Calif. 150.
 effect of potash, Fla. 434.
 of Texas, quality, 835.
 seed, germination, Fla. 434.
 seedlings as rootstocks for citrus, Hawaii 737.
 trees, bark scaling and exfoliation, Fla. 438.
 trees, growth, effect of rootstock, Calif. 734.
Grapes—
 breeding for New York State, value of European sorts, 842.
 Concord, fertilizer experiments, Mich. 740.
 cultivation v. mulching, Nebr. 829.
 culture, N.Mex. 535.
 culture experiments, R.I. 534.
 culture, treatise, 640.
 effect of girdling, Calif. 736.
 Moore Early, value for Michigan, Mich. 436.
 notes, V.I. 737.
 spraying, Mo. 840.
 thinning studies, Calif. 736.
 varietal and cultural notes, Fla. 435.
 variety tests, Miss. 39; N.J. 833; N.Mex. 227.
Grapevine flea beetle, notes, 651.
Grapevines—
 brunnisure of, 345.
 leaf area, effect of pruning, Mass. 340.
Graphium ulmi, notes, 543.
Grapholitha conversana on clover in Oregon, 758.
Grass staggers, treatment, effect of calcium chloride injection, 472.
Grasses—*see also* Grassland, Meadows, *and* Pastures.
 breeding, V.I. 730.
 cutting tests, Fla. 430.
 effect of source of nitrogen, Mass. 330.
 fertilizer experiments, Ala. 428.
 for artificial reseeding of ranges, N.Mex. 32.
 forage, culture, Hawaii 730.

Grasses—Continued.
forage, variety tests, Wyo. 127.
introduced, notes, V.I. 730.
mixtures, tests, Wyo. 127.
of Maryland, Md. 129.
on alkaline v. acid plats, R.I. 527.
protein content, effect of cutting. 33.
turf, studies, N.J. 824.
variety tests, Ala. 428; V.I. 730.
water requirements, 822.
Grasshoppers—
affecting tobacco, Conn.State 356.
as intermediate hosts of nematodes, U.S.D.A. 181.
as vectors of potato diseases, Nebr. 348.
food preferences, 851.
in Mongolia, 244.
transmission of potato spindle tuber by, 238.
Grassland—*see also* Grasses, Meadows, *and* Pastures.
botanical composition, effect of treading, 222.
improvement, 527.
management, intensive, 254.
Gravitation, effect on root tips, 423.
Grazing—*see also* Range.
privileges in national forests in Utah, U.S.D.A. 141.
young or old cattle, advantages, 883.
Green manure—
crops, culture, Hawaii 730.
crops for corn, comparison, N.J. 824.
crops in Cotton Belt, U.S.D.A. 223.
crops, tests, V.I. 730.
effect on composition of soil, Fla. 416.
effect on tobacco, 531.
Greenhouse leaf tyer, spined soldier bug reared on, 53.
Grinder, small farm feed, description, 677.
Grouse locust, inheritance of color patterns in, 217.
Grouse—
of Wisconsin, studies, 243.
ruffed, host of spirurids, U.S.D.A., 182.
Grove Karl Gilbert loan fund, notes, 105.
Guinea hens, parasite of, 877.
Guinea pigs—
albino v. colored, for experimental use, 625.
growth differentiation in, genetic, U.S.D.A. 26.
male, accessory glands of reproduction, 122.
vital staining, Mich. 174.
Gymnosporangium germinale, notes, 351.
Gynergen action on gravid bovine uterus, 868.
Gypona octolineata, transmission experiments of cranberry false blossom, 358.
Gypsum—
dusts, effect on transpiration rate, N.C. 118.
soils, slick spots in, studies, Nev. 720.
Gyrinidae, Chinese, status of knowledge, 547.
Habit the driving factor in evolution, 725.
Habrobracon, genetics of, N.C. 153.
Habrobracon juglandis, genetics of, N.C. 122.
Habrocytus saxeseni, oviposition, 552.
Haematobia irritans, notes, 50.
Hairy root organisms, studies, Wis. 440.
Halibut-liver oil, absorption curves of acids, 805.
Haltica ampelophaga, notes, 651.
Haltica torquata, *see* Blueberry flea beetle.
Hams, sugar-cured v. salt-cured, Tenn. 861.
Harlequin bug, studies, N.C. 153.
Harmolita grandis, *see* Wheat strawworm.
Harmon Award, notes, 800.
Harper Adams Pig Feeding Experimental Station, work, 662.
Hartigia cressoni, studies, Calif. 53.
Harvest ant, activity, factors affecting, 852.
Harvester, small grain, new type, tests, 275.
Hawaii Station, report, 797.
Hawaii University, notes, 599.
Hawaiian Sugar Planters' Station, notes, 497.
Hay—
and corn yields, Ohio 481.
artificial drying, 577.
crops, emergency, N.J. 824.
crops, experiments, Ala. 331.
crops, variety tests, N.Mex. 221.
drying, tests, Ind. 183.
measuring in stacks, U.S.D.A. 77.
native, effect on milk production, Wyo. 171, 766.
production in New Jersey, N.J. 31.
production, labor requirements, Conn.Storrs 781.
tepary bean v. cowpea, for cattle, Okla.Panhandle 171.
Haystacks, volume and tonnage, determination, U.S.D.A. 577.
Health, public—
and educational services in Michigan, Mich. 88.
relation to entomology, N.Mex. 244.
Heart block in pigeons, curative factor, 596.
Heat—*see also* Temperature.
eliminated by human being, 792.
Heating of rooms with direct steam radiators, 297.
Hedges, studies, Mass. 436.
Heifers—*see also* Cows.
calcium requirements, 767.
dairy, mineral requirements, Mass. 370.
effect of cottonseed meal and alfalfa ration, N.Mex. 259.
effect of feeding raw crushed cottonseed, Mich. 766.
effect of low phosphorus ration, Mich. 766.
feeding, care, and management, 561.
ground soybeans v. linseed meal for, Ind. 169.
sterility in, etiology, Iowa 170.
stocker, wintering, Ala. 459.
value of grain for, Wyo. 171.

Heifers—Continued.
winter feeding, N.J. 865.
Helicobasidium purpureum and *Rhizoctonia crocorum*, identity, 444.
Heliothis obsoleta, *see* Bollworm *and* Corn ear worm.
Heliothrips—
fasciatus, life history, Calif. 754.
indicus, notes, 246.
Helminth parasites of sheep and goats, differential diagnosis, 572.
Helminthosporium—
heveae, notes, 344.
sacchari, toxic substance produced by, 238.
sativum, notes, 345, 441.
sp., notes, 46.
stenospilum n.sp., notes, 46.
Hemicellulose in woody plants, 25.
Hemileia on coffee, 644.
Hemileia sp., notes, 344.
Hemileia vastatrix, notes, 344.
Hemlocks, western, layering habit in, 643.
Hemoglobin—
building and synthetic rations, 893.
formation, 289.
in blood, manometric determination, 206.
in blood of chicks, effect of confinement, 259.
maintenance on synthetic diets, 92.
production, studies, 597.
regeneration, rôle of manganese in, 297.
Hemoglobinemia, puerperal, of bovines, 775.
Hemoglobinuria of cattle, 378.
Hemorrhagic disease in cattle, Nev. 775.
Hemorrhagic eschar type of skin lesions, etiology, Ala. 471.
Hemp experiments, Can. 825.
Hemp, sex in, 424.
Hens, laying—*see also* Egg production.
effect of forced molting, Ala. 464.
mortality in, causes, Mich. 473.
selection, 64.
Hens, variations in local prices, Mo. 485.
Heredity—
and development, theoretical discussion, 623.
and environment, interdependence, 520.
in Asiatic cotton, 724.
in cotton, 121.
in man, chromosome theory, 324.
in pigs, 327.
in poultry, 328.
in rice, 522.
in wheat crosses, 325, 724.
of base colors in *Lolium perenne*, 121.
of body weight in fowls, R.I. 820.
of characters in flax, 817.
of chocolate pericarp in corn, 521.
of color, *see* Color inheritance.
of creeper traits in fowl, 425.
of dwarf branching habit in sweetclover, 325, 424.
of leaf length and width in barley, 521.
of mice hybrids, 328.
Heredity—Continued.
of morphological characters in cattle, 122.
of soft starch in corn, 521.
of white capping in yellow corn, 521.
sex-linked, relation to sex chromosomes in breeds of sheep, 217.
treatise, 724.
Herring oil, comparison with cod-liver oil as to vitamin content, 397.
Hesperioidea of North America, 655.
Hessian fly—
infestation, relation to vigor of plant, 454.
larva, anatomy, 456.
wild grasses as hosts, 457.
Heterocampa—
bilineata, notes, Mich. 153.
guttivitta, outbreak, Conn.State 451.
Heterodera radicicola—
biological studies, Calif. 754.
notes, 345.
Heterosporium—
gracile, notes, 542.
pruneti n.sp., description, 242.
Hevea brasiliensis, *see* Rubber.
Hexosans, storage in seeds, Iowa 119.
Hexylresorcinol as anthelmintic, 568, 874.
Hibisceae, cytology, 520.
Hickory—
bark beetle infestation, relation to lowered tree vitality, 454.
shuck worm, control, Fla. 452.
twig girdler, notes, Conn.State 451.
Hiding power measurements, theory and application, 76.
Highway development in continental United States, U.S.D.A. 778.
Highways, *see* Roads.
Hispa armigera, life history, 657.
Hitch, combination cushion spring and clutch release, studies, 577.
Hitches, big, on Illinois farms, 254.
Hog cholera—
and dog distemper experiments, 269.
blood, infectivity of cells, 674.
of central nervous system, histological studies, 381.
outbreak, 567.
vaccine, notes, Calif. 770.
Hog stomach preparations for pernicious anemia, 296.
Hogs, *see* Pigs.
Hollyhock diseases, N.J. 352.
Holyomorpha picus on beans in South China, 359.
Home—
demonstrations, enlarging content and influence, 889.
economics and White House Conference, 889.
economics education, prospects for progress, 89.
economics teaching, individual assignment, 889.

Home—Continued.
farm, and community, interrelations, 686.
maintenance and repair, treatise, 299.
relations, high school courses in, 90.
Homoptera, biology, N.C. 153.
Honey—
catalase, 856.
colloids, properties and removal, 408.
crystallization, 856.
diastase, variation in, Calif. 755.
in ices and sherbets, 69.
in storage, effect of temperature, 856.
moisture determination, methods, 856.
organic acids in, 408.
plants in Iowa, Iowa 153.
plants of State, N.C. 153.
production in suburban area, N.J. 849.
statistics, U.S.D.A. 486.
studies, 855.
use in water ices and sherbets, 488.
v. sucrose in bread making, 394.
yield in Egypt, improvement, 58.
Hoofs, normal and pathological, statics of pododerm, 869.
Hop wilt, notes, 644.
Hormone—
female, in fowls, plumage and oviduct response to, 28.
female sex, from human pregnancy urine, effect on dogs, 427.
of human placental origin, effect on oviduct of ovariotomized fowl, 220.
Horn fly, developmental stages, length, 50.
Hornet, European, increase in Maryland and other States, 59.
Horse—
brain, senile changes of, 869.
nose flies, control, 56.
Horses—
anemic condition proving fatal, Ind. 174.
breeding and breeds, 27.
breeding by artificial insemination, 27.
breeding industry, effect of stallion law, 254.
champion pulling teams, 254.
disease of frontal sinus, 869.
febrile conditions, treatment with selectan, 870.
feeding and breeding experiments, Can. 60.
feeding experiments, Wis. 461.
inbreeding, 254.
light, breeding, treatise, 556.
metabolism harness for, 254.
moribund, blood picture, 868.
needed experimental work, 254.
parasites and parasitic diseases, U.S.D.A. 72.
poisoning with laurel, U.S.D.A. 177.
posture and movement, value of lacertus fibrosus and of tendo femorotarseus on, 568.
posture of bones in, 567.
research work in England, 482.
statistics, U.S.D.A. 486.
Horseweed as host for black scale, Calif. 756.
Horticulture, dictionary, 227.
Hose for fighting rural fires, tests, N.J. 578.
Hotbeds, electric, operating costs, Mo. 881.
House construction, light frame, 780.
House flies—
nutrient for, 453.
rearing for testing purposes, 846.
sodium fluosilicate v. borax for control, 458.
Household insects, 53.
Huckleberries, insects affecting, Me. 756.
Humidity—
in air and wood in fresh-air chambers, control, 323.
relative, instrument for testing, 520.
relative, thermometer for measurement, 808.
Humus investigations, Iowa 113.
Hyacinth diseases, notes, 542.
Hyalomma mauritanicum, transmission of theileriosis by, 776.
Hyalopterus arundinis, *see* Plum aphid, mealy.
Hybrid vigor—
in kernel weight of wheat crosses, 634.
in wheat, *624.*
Hybridization nodules on cruciferous plants, 539.
Hydrocarbons, paraffin, detonation characteristics, 274.
Hydrogen—
ionization, rôle in insect control, 651.
peroxide, germicidal value, effect of sulfates, Wis. 471.
peroxide, rate of decomposition, effect of copper and lead ions, 504.
Hydrophobia, *see* Rabies.
α-Hydroxy-β-sulfhydryl propionic acid, oxidation-reduction potentials, 204.
Hylemyia cilicrura, *see* Seed-corn maggot.
Hymenolepis sp. in turkeys, treatment, *Mich. 176.*
Hymenoptera—
parasitic, new species, 59.
parasitic, polyembryony among, U.S.D.A. 157.
Hypercalcemia induced by irradiated ergosterol, source of excess calcium, 194.
Hyperthyroidism in Brown Leghorn fowls, effect, 220.
Hypervitaminosis D, studies, 896.
Hypervitaminosis in fowls, 96.
Hypholoma incertum, sterol production and antirachitic activatibility, 398.
Hypoderma lineatum larvae, oesophageal stage, in Indian cattle, 250.
Hypophysis—
anterior lobe, crystals from, effect on mice, 219.
effect on menstruation, 29.
Hypsometers, test on short trees, 342.
Ice cream—
and milk plant inspection, papers on, 865.

Ice Cream—Continued.
body and texture, effect of homogenizing pressure, Conn.Storrs 769.
chocolate, type of flavoring, 68.
distribution of constituents, relation to temperature, Calif. 768.
dry skim milk in, N.Y.Cornell 173.
freezer blades, sharp v. dull, Md. 868.
freezer blades, sharpening, effect on power requirements, Calif. 778.
mix, aging, effect of cooling temperature on galatin in, 263.
mix, aging time, Mass. 371.
mix, basic viscosity, 565.
mix, effects of butter, condensed milk, and skim milk powder, Mich. 769.
mix, pasteurization, high temperatures for, Mich. 470.
mix, properties, effect of pasteurizing and homogenizing temperature, 667.
mix, titratable acidity and pH, relation, 263.
quality, speed of dasher and scraper affecting, 667.
sandy, cause, 263.
sanitary control, 866.
taint in, prevention, 68.
texture and quality, Ind. 172.
use of dry skim milk in, N.Y.State 374.
use of frozen fruits in, Mass. 394.
use of gelatin in, Mass. 372.
Ice well for dairy farm, construction, U.S.D.A. 78.
Icerya purchasi, see Cottony cushion scale.
Ices, honey in, 69.
Ichneumon flies, new species, descriptions, 552.
Idaho Station, notes, 199.
Idaho University, notes, 199.
Illinoia pisi, see Pea aphid.
Illinois Station, notes, 199.
Illinois University, notes, 199.
Inbreeding work, papers on, 254.
Incubation of eggs, effect of chilling, Calif. 764.
Incubator—
kerosene, electrifying, Mich. 479.
room for insect study, construction, 453.
temperatures, laboratory, 866.
Incurvaria trimaculella quadrimaculella, lepidopterous enemy of, 550.
Index numbers—
elucidated, 578.
of prices of agricultural products, 279.
of production, prices, and income, Ohio 481, 678.
Indiana Station, notes, 798.
Indiana Station, report, Ind. 198.
Indians, basal metabolism, 395.
Indicator crops, R.I. 512.
Industries, basic, and social history of Japan, 586.
Infants—*see also* Children.
diets, vitamin B in, 694.
Infants—Continued.
food preparations of powdered milk, bacteriologic study, 693.
underwear, materials and types for, 696.
Inheritance, *see* Heredity.
Injections, liability in undertaking, 870.
Insect—
attack, developing resistance to, 454.
epidemiology, fundamentals, 851.
fauna of Brazos County, Tex., 899.
population, effect of 1930 drought, symposium, 845.
trap for study of insect dispersal and flight associations, 845.
Insecta, evolution of class, 353.
Insecticidal and fish poisoning plants, U.S.D.A. 846.
Insecticides—*see also* Sprays *and specific forms*.
analyses, Me. 137; N.J. 40.
contact, efficiency, 357.
contact, numerical rating for, N.H. 846.
for codling moth control, tests, 654.
lethal power against corn borer, 457.
notes, Iowa, 153.
studies, 50; N.J. 849.
toxic action and passage through membranes, Calif. 753.
Insects—*see also* Entomology.
affecting stored products, effect of certain radio waves, 652.
and climate, 845.
and insecticides, notes, 50.
and other invertebrates in 1930, 852.
and pests of Asia Minor, 852.
and pests of greenhouse plants, Mich. 757.
beneficial, for orchard colonization, Calif. 756.
causing damage to lumber, Ohio 852.
control, materials for, Mass. 353.
control, oxytofactor in, 651.
ecology and epidemiology, 852.
economic—
control in New Jersey, 651.
in China, 546.
in Italy and dependencies, 546.
in Spain, 651.
Fabrician types, in Hunterian Collection at Glasgow, 353.
hatching from eggs, 244.
immunity in, 852.
in stored products, studies, 551.
injurious—
in Pusa, 651.
in Rhodesia, 651.
in Sardinia, 546.
in South Australia, 651.
to crops, *see special crops*.
introduced, future distribution, predicting, 244.
of stored grain, parasites, 552.
of Tanganyika, 547.
relation to virus diseases of potatoes, 757.

Insects—Continued.
relation to weather and climate, 851.
scale, *see* Scales.
social behavior in, 651.
stigmata, anatomy, 546.
ticks, mites, and venomous animals of medical importance, treatise, 244.
tracheal system, first appearance of gas in, 244.
Insemination, artificial—
of fowls, results, 27.
of livestock, 27.
practice in Russia, 27.
International—
Association of Dairy and Milk Inspectors, report, 865.
Association of Milk Dealers, Laboratory section, proceedings, 259.
cattle atlas, 660.
Conference of Agricultural Economists, proceedings, 78.
Congress of Agriculture, papers, 581.
Congress of Genetics, notes, 500.
Cooperative Congress, proceedings, 87.
Country Life Commission, report, 586.
Institute of Agriculture, administration and control, 79.
Society of Sugarcane Technologists, proceedings, 530.
Invertase, adsorption of, Mich. 413.
Iodine—
colloidal, for dairy calves, N.J. 864.
colloidal, for treatment of intestinal parasites, Mich. 772.
content of thyroid gland, factors affecting, 97.
in blood, determination, 314.
in Florida-grown produce, Fla. 434.
organic, for abortion control, N.J. 872.
vermicidal value, Mich. 176.
Iodine-starch reaction, factors affecting, 313.
Iowa College, notes, 300.
Iowa Station, notes, 300, 900.
Iowa Station, report, 198.
Ips cembrae, biology and ecology, 852.
Iris—
diseases, 542; N.J. 352.
new Heterosporium parasitic on, 242.
Irises, variety tests, N.C. 136.
Iron—*see also* Ferric.
and amino acids, mode of combination, 10.
and copper treatment of anemia in children, 690.
and proteins, mode of combination, 10.
cast, effect of under-stressing, 75.
galvanized, solubility in milk, Wis. 469.
in dry milk, 290.
in nature, transformations, 801.
in organs and body fluids, determination, 312.
in vegetables, conservation by methods of preparation and cooking, Miss. 891.
metabolism, research on, results, 690.
Iron—Continued.
open-hearth, effect of under-stressing, 75.
requirements of children, 290.
salts for lime-induced chlorosis, Calif. 150.
systems, complex, potentiometric studies, 204.
Irrigation—
and drainage of rice fields, papers on, 628.
Division, Special, of Bombay, research work, 383.
effect on alfalfa white spot, 44.
effect on berry crops, Oreg. 740.
effect on farm machinery design and development, 575.
effect on phosphorus availability of rice soils, 212.
for rice in Calauan, Laguna, 879.
in Java, importance, 530.
studies, Calif. 778; N.Mex. 272.
Isopods as intermediate hosts of nematodes, U.S.D.A. 181.
Isorotenone, toxicity to goldfish, 547.
Ithycerus noveboracensis, *see* New York weevil.
Ixodes ricinus, latent parasitism of *Ixodiphagus caucurtei* in, 59.
Ixodiphagus caucurtei, latent parasitism, 59.
Jack fruit mold, notes, 344.
Japanese beetle—
distribution in United States in 1930, 57.
in Connecticut in 1930, Conn.State 451.
parasite, studies, U.S.D.A. 157.
parasites, establishment in United States, 458.
population, changes in, 57.
trapping, 57.
Japanese mealybug, biological control, Calif. 156.
Jardine, J. T., editorial, 701.
Jaundice—
in dogs, cause, 567.
in experimental coccidiosis of rabbits, 73.
Jellies, rôle of pectin in, Del. 407.
Jerusalem-artichoke—
fertilizer experiments, N.J. 824.
improvement, N.J. 824.
Jessamine, willow-leaved, poisoning of ruminants by, 278.
Jimson weed, poisonous to livestock, Ind. 70.
Johne's disease in cattle, 71.
Johnson grass—
control, N.Mex. 221.
cutting experiments, Ala. 428.
value for hay, Ala. 331.
Jordan, W. H., editorial note, 101, 102, 107.
Joseph Horák Fund, notes, 600.
Joseph Munzar Fund, notes, 600.

Journal of Agricultural Research, policy and functions, 889.
Jujubes, varietal and cultural notes, Fla. 435.
June beetle, green, notes, N.Mex. 245.
June beetles—
crop selection for egg laying, 458.
notes, Iowa 153.
Juniper webworm, control, N.J. 850.
Jute, treatise, 34.
Kabatiella caulivora and *Colletotrichum trifolii*, comparison, 539.
Kafir, culture under dry-farming conditions, N.Mex. 527.
Kala-azar—
infantile, in Italy, sand flies in endemic foci, 361.
Mediterranean, transmission by *Rhipicephalus sanguineus*, 553.
Kale, variety tests, Ala. 434.
Kansas College, notes, 497, 698, 798.
Kansas Station, notes, 497, 698, 798.
Keitt single-spore method, modified procedure, Tex. 899.
Kentucky Station, notes, 900.
Kentucky Station, report, 99.
Kentucky University, notes, 900.
Keratitis, papers on, 869, 870.
Khartoum Laboratory, activities during 1929, 246.
Kidney worm of pigs, 776.
Kidneys, structure in rats, effect of fat-free diet, 892.
Klip as fly repellent for milking cows, N.J. 864.
Kodra smut, notes, 441.
Kohlrabi, maggot injury, Me. 749.
Kudzu, cutting experiments, Ala. 428.
Labor—*see also* Agricultural labor.
problem in beet raising countries of Europe, 581.
Labrador Pond and Peterboro Swamp areas, biological reconnaissance, 545.
Lac insects, symbiotes, 547.
Lace bugs, infestation, relation to vigor of plant, 454.
Lacewings—
brown, notes, Calif. 156.
green, notes, Calif. 156.
Lachrymal canula, paper on, 869.
Lactation—
curve, analysis, 66.
curve in Guernsey cattle, stability, 254.
dietary factors affecting, 289.
effect of ovarian hormones, 329.
effect of pituitrin injection, 329.
relation to diet, 395.
Lactic acid, production, continuous fermentation in, 411.
Lactobacillus—
acidophilus stored at various temperatures, viability, 565.
bulgaricus stored at various temperatures, viability, 565.
Lactose—
beta anhydrous, changed to alpha hydrous by free water, 409.
crystal, new form in sandy ice cream, 263.
in milk, effect of interval between milkings, Calif. 768.
Lady beetle, Chinese, in a citrus grove, Fla. 451.
Ladybird beetle, morphology and biology, 253.
Lamb—
cuts, boning, U.S.D.A. 689.
quality and palatability, factors affecting, Nebr. 859.
Lambs—*see also* Sheep.
digestive disorder, causes, Wis. 471.
enzootic lameness in, cause, Calif. 771.
fattening, Minn. 62; Nebr. 859.
fattening, hand-feeding v. self-feeding, Ohio 661.
fattening, rations for, Nebr. 660.
feeding experiments, Idaho 255; Nebr. 859.
for spring market, feeding grain to, Ala. 460.
growth rate, Nev. 761.
hand-feeding v. self-feeding, Ohio 661; Wis. 460.
on pasture, need of grain supplement, Wis. 460.
production, Ind. 61.
production, crossbreeding experiment, 365.
raising to marketable age, cost, N.C. 160.
sore mouth in, complications, 572.
stomach worms in, control, N.C. 179.
suckling, pasture v. grain for, Ind. 159.
v. mature sheep, grass consumption, Nev. 761.
variations in local prices, Mo. 485.
weight and grade, relation to weight of pelts, 254.
western, fattening, type test, Ind. 61.
Lamb's quarters, water requirements, 128.
Land—
credit, *see* Agricultural credit.
different classes, sale price, relation to assessed values, U.S.D.A. 186.
economics, conferences on, 580.
grant colleges, *see* Agricultural colleges.
natural geographic divisions, Mich. 678.
ownership, rural, economics of, 581.
plaster, *see* Gypsum.
policies, national, 580.
reclamation, studies, Nev. 720.
settlement—
in cut-over region of Great Lakes States, U.S.D.A. 278.
problems in Australia, 79.
State policies in, 580.

Land—Continued.
survey of town of Durham, N.H. 278.
utilization—
for recreation purposes, Wis. 481.
in United States, outlook, 580; U.S.D.A. 883.
problem in Northeastern States, 79.
relation to population trends, 79.
Lands—
cut-over, *see* Cut-over lands.
unappropriated, of Western Range States, 580.
wet, drainage and improvement, Oreg. 575.
Larch—
bark beetle, eight-toothed, biology and ecology, 852.
canker, studies, 543.
sawfly in Canada, status, 553.
Lard, cold storage holdings, U.S.D.A. 784.
Larkspur—
annual, cytological studies, Calif., 736.
poisonous to livestock, Wyo. 177.
Laryngotracheitis—*see also* Bronchitis, infectious.
avian, filtrable virus-like agent in, 573.
infectious, in pheasants, 573.
Lasioderma serricorne, *see* Tobacco beetle.
Laspeyresia molesta, *see* Peach moth, oriental.
Latitude, effect on litter size, 725.
Laundry—
plant, home, efficiency, Wash.Col. 197.
winter damage, 598.
Laurel—
diseases, N.J. 352.
mountain and sheep, poisonous to livestock, U.S.D.A. 177.
Lavender shab disease, studies, 649.
Lawns—
chinch bug injury, Conn.State 451.
management, 628.
Lead arsenate—
acid, toxicity to Colorado potato beetle, 855.
and soap, effect on conifers, 50.
corrective and sticker for, 847.
penetration into sod, N.J. 850.
v. nicotine tannate for codling moth control, 55.
Leaf—
mining buprestid, new, in Canal Zone, 657.
mining insects, ecology and classification, 852.
spot resistant fruits, breeding, Tenn. 840.
tissue and plant solutions, moisture fluctuations in, 214.
Leafhopper, six-spotted—
morphological and cytological studies, 359.
transmission of yellows disease by, Calif. 753.
Leafhoppers—*see also special hosts.*
control, N.J. 838.
in cranberry bogs, relation to false blossom, 358.
North American, of Athysanella group, key, 247.
notes, 246.
studies, 54.
Leaves—
mineral content, effect of fertilizers, 25.
reflection of light from, 518.
Lecanium corni—
mortality, 549.
natural enemies, 549.
Lecanium scale affecting fruit and shade trees, 654.
Lecithin, effect on—
sex ratio in albino rats, 426.
stability of serum proteins, 803.
Legislation, agricultural and social, in New Zealand, 79.
Legume—
inoculants, inspection, N.J. 39.
inoculants, sale, State laws, N.J. 634.
pod-borers in Porto Rico, distribution, life history, and food plants, 457.
Legumes—*see also* Green manure *and* Alfalfa, Clover, *etc.*
as nitrogen-fixers, Hawaii.Pineapple Canners' 813.
breeding, V.I. 730.
effect of fertilizers, Calif. 735.
inoculation—*see also* Nodule bacteria.
effect on soil conditions, Iowa 114.
leafhopper injury, 43.
relation to nitrogen fixation, Mass. 817.
summer, as cover crops, Calif. 727.
variety tests, V.I. 730; Wis. 431.
winter—
breeding, Ala. 428.
fertilizer experiments, Ala. 428; Fla. 429.
for green manure in Cotton Belt, U.S.D.A. 223.
variety tests, Ala. 428; Miss. 31.
Leishmaniasis, visceral, sand flies in endemic foci, 361.
Lemna major, stimulation by organic matter, 514.
Lemon—
juice, vitamin C in, concentration and chemical nature, 503.
leaves, sap concentration and inorganic constituents, Calif. 232.
peel peroxidase, inactivation temperature, effect of pH, 214.
trees, growth, effect of rootstock, Calif. 784.
Lemons, seed germination, Fla. 435.
Leopard moth as apple orchard problem, N.J. 848.
Lepidopterous larvae, action of contact insecticides on, 852.
Lepidosaphes ulmi, *see* Oyster-shell scale.

Leptinotarsa decemlineata, *see* Potato beetle, Colorado.
Leptobyrsa rhododendri, *see* Rhododendron lace bug.
Leptocorisa—
acuta, bionomics and control, 247.
varicornis in Ceylon, control, 247.
Leptoglossus gonagra, notes, 851.
Leptomastidea abnormis, notes, Calif. 156.
Leptosphaeria—
coniothyrium on dewberry, control, N.C. 147.
sacchari, notes, 344.
Leptospira ictero-haemorrhagiae in rats in Trinidad, 353.
Lespedeza, variety tests, N.C. 126; Tenn. 825.
Lesquerella lepidota n.sp., description, 817.
Lettuce—
fertilizer experiments, R.I. 534.
head, production, West.Wash. 138.
hybrid seedlings, notes, Hawaii 737.
production under Vitaglass, Mass. 339.
shipments, Fla. 481.
shipments from Florida and competing areas, Fla. 886.
tipburn, studies, N.C. 136.
unsaponifiable lipids in, 203.
variety tests, Ala. 434.
vitamin B complex in, 590.
Leucopis bella, notes, Calif. 156.
Leucotermes flavipes in buildings, Mich. 153.
Leukemia—
in fowls, 270, 381; Mo. 72.
in fowls, new transmissible strain, 381.
Levulose, value for preservation of eggs by freezing, 411.
Life, duration, chromosome balance as factor, 724.
Light—*see also* Sunlight.
all-night, effect on egg production, Ohio 560.
artificial, treatise, 195.
as attrahent to codling moth, Calif. 752.
of different wave lengths, effect on stomatal opening, 215.
reflection from leaf surfaces, 518.
Ligniera vascularum, life history, 349.
Lignin—
alkali, synthetic resins from, 409.
properties and uses, Va. 40.
Liliaceae, family, discussion, Tex. 817.
Lima beans, *see* Beans, Lima.
Lime—*see also* Calcium *and* Liming.
analyses, N.J. 23.
arsenate, see Calcium arsenate.
effects on cigar tobacco, 46.
in soils, duration, Mich. 718.
incompatibility with fluosilicates, 51.
nitrogen, *see* Calcium cyanamide.
products, inspection, Mass. 23.
requirement, studies, Miss. 126.
sources for mineral supplements of dairy cattle, Mich. 765.
Lime (fruit)—
tree wither tip, notes, 344.
Limestone—
effect on cotton, Ga. 123.
effect on soybeans, N.C. 127.
Lime-sulfur—
dry, value as spray, Mo. 340.
fungicidal value, Mo. 340.
v. Bordeaux mixture for apple scab, Tenn. 150.
value for apple scab, Wis. 440.
Liming—*see also* Lime *and special crops*.
effect on onion culture, Ohio 388.
effect on soil conditions, Iowa 114.
effect on solubility of soil magnesium, N.C. 114.
experiments, N.C. 115.
sandy soils, effect, Fla. 415.
Limonius agonus on tobacco, Conn.State 356.
Linkage—
and inheritance relations of chocolate pericarp in corn, 521.
groups in poultry, 328.
Linseed meal—
as supplement for fattening lambs, Minn. 62.
v. ground soybeans for heifers, Ind. 169.
Lipeurus tropicalis n.sp., description, 548.
Lipids, unsaponifiable, in lettuce, 203.
Liponyssus sylviarum, notes, 757.
Liquor amnii of domestic animals, pH and ferment in, 869.
Litter size and latitude, 725.
Liver—
extract as source of vitamins B and G, 492, 493; Ala. 493.
oils and vitamin A, spectrographic data, 804.
subacute atrophy, 567.
Livestock—*see also* Animals, Mammals, Cattle, Sheep, *etc.*
atlas, international, 660.
business, importance of Court of Arbitration, 870.
commission rates, 386.
cooperative marketing, 685.
diseases, *see* Animal diseases *and specific diseases*.
experimentation, group feeding method, 253.
experimentation, value and limitations, 253.
industry of Germany, condition of production and marketing, 582.
insurance, organization, 80.
judging, elements, textbook, 586.
judging, relation to commercial requirements, 662.
marketing, effect of trucks, 883.
marketing, trends in, 79.
on range, forage preferences, determination, 856.

Livestock—Continued.
poisoning—*see also* Plants, poisonous, *and specific plants.*
by *Cestrum parqui,* 378.
by fitweed, Nev. 668.
by laurel, U.S.D.A. 177.
production trends, U.S.D.A. 482.
pure breeds, standards of excellence, 662.
ranches, research on, 80.
reporting, 80.
statistics, *see* Agricultural statistics.
trucking, statistics, Iowa 684.
types and market classes, treatise, 60.
Living, standard of, *see* Standards.
Loco, new, from Edwards Plateau of Texas, Tex. 899.
Locust, black—
bark, poisonous to livestock, Ind. 70.
strength of wood, effect of extractives, 779.
Locusts—
control in Northern Kordofan, 246.
desert, biology and control, 359.
invasions in Gold Coast, 246.
life history and control, 246.
season in the Sudan, 246.
winter breeding in the Sudan, 246.
Loganberry—
blue stripe wilt, notes, 644.
spot, notes, 644.
Logging—
and milling studies, Calif. 742.
slash and forest protection, Wis. 644.
Logs—
and poles, use in farm construction, U.S.D.A. 479.
and stumpage, prices, U.S.D.A. 43.
Lolium perenne, inheritance in, 121.
Louisiana Stations, notes, 497.
Louisiana University, notes, 497.
Louping-ill, nature of, 379.
Louse, head, control, 453.
Lubricants, production by hydrogenation, 273.
Lucern, *see* Alfalfa.
Lucilia sericata—
hatching of eggs, 244.
notes, 551.
Ludius pruininus var. *noxius* in Pacific Northwest, U.S.D.A. 58.
Lumber—*see also* Timber *and* Wood.
damage caused by insects, Ohio 852.
production and wood utilization in southeastern Minnesota, Minn. 42.
production in Ohio, Ohio 837.
standards, American, provisions and scope, U.S.D.A. 142.
Lung flukes in American mink, 73.
Lycidae of China, 546.
Lyctus spp., notes, 852.
Lygaeonematus erichsonii in Canada, status, 553.
Lygus—
pabulinus on black currants, control, 653.
pratensis, see Tarnished plant bug.
Lygus—Continued.
spinolae of Schilcher vine in Styria, 851.
Lymphadenitis, caseous, of sheep, cause, 570.
Lyperosia exigua in Australia, 551.
Lysine, dissociation constants, 10.
Macadamia nuts, composition, Hawaii 737.
Machinery, *see* Agricultural machinery.
Mackerel, horse, monoamino acids in, 310.
Macrocentrus ancylivora—
mass production and distribution, 59.
notes, 55; N.J. 54.
parasite of oriental peach moth, Ind. 152.
Macrocentrus—
delicatus, notes, N.J. 54.
gifuensis, parasite of European corn borer, U.S.D.A. 156.
harrisi n.sp., description, 59.
Macromeigenia genus, synopsis, Tex. 899.
Macrophomina phaseoli, notes, 441.
Macrorileya oecanthi, notes, Calif. 53.
Macrosiphum gei, vector of virus of breaking in tulips, 247.
Macrosiphum solanifolii, see Potato aphid.
Macrosiphum, red, on lettuce, description, Va.Truck 156.
Macrosporium solani, notes, N.J. 838.
Mad itch, relation to pseudorabies, 872.
Magnesia—
deficiencies of sandy soil types, N.C. 114.
relation to burning qualities of cigar leaf tobacco, Conn.State 336.
Magnesium—
deficiency, effect on fruit trees, 638.
determination with 8-hydroxyquinoline, 504.
Magnolia scale, control, N.Y.Cornell 53.
Maine Station bulletins, index, 797.
Maine Station, notes, 200.
Maize, *see* Corn.
Malaria—*see also* Mosquitoes *and* Anopheles.
in Egypt, work of Anti-Malaria Commission, 550.
transmission in Philippines, 550.
Male sterility in corn, 819.
Mallophaga of domestic animals, 869.
Malta fever, *see* Undulant fever.
Mamestra brassicae, larvae, color variation in, 546.
Mammals—*see also* Animals *and specific kinds.*
avian tuberculous infection in, 267.
of Philippines, 545.
sex gland and germ cell formation, 725.
wild and domestic, animal parasites, 244.
Mammary—
gland, experimental development, 254.
growth, effect of ovarian hormone, 329.
Mammitis, *see* Mastitis.
Man, chromosome number in, 217.
Man, inheritance in, chromosome theory, 324.

Manamar, feeding value, N.J. 865.
Manganese—
as soil amendment for tomatoes, Fla. 434.
deficiency in soybean plants, N.C. 115.
determination in animal materials, 12.
determination, method of oxidizing and dissolving soil for, 312.
essential for plant growth, 119.
in foods, Wis. 491.
metabolism of rats, 490.
relation to nutrition, 192.
rôle in nutritional anemia, 297.
sulfate, effect on soils, Mass. 22.
Mangels—
culture under dry farm conditions, Utah 627.
effect of preceding crop, R.I. 527.
yields, effect of source of potash, R.I. 526.
Mango—
diseases, notes, 344.
weevils, synonymy, 552.
Mangosteen disease, notes, 344.
d-Mannose from culture medium of tubercle bacilli, 205.
Manure—*see also* Cow manure.
and fertilizers, efficiency, R.I. 511.
artificial, production, Iowa 113.
as supplement to commercial fertilizers for tobacco, Conn.State 335.
care, use, and economic value, Oreg. 815.
effect on *Nicotiana rustica*, 632.
nitrogen availability under field conditions, 515.
nitrogen in, conservation and availability, 514.
preservation under arid conditions, N.Mex. 118.
storage tests, N.Mex. 221.
value on sandy soil, Ind. 124.
Manuring experiments and rotation of crops, Utah 627.
Maple—
bladder gall mite, control, N.Y.Cornell 53.
Norway, leaf-stalk borer on, Conn. State 451.
Maples, sugar, effect of dormant oil sprays, 50.
Marasmius oreades, sterol production and antirachitic activatibility, 398.
Market—
gardens, *see* Truck crops.
public, conditions essential for, U.S. D.A. 585.
reporting, international cooperation in, 79.
reports, U.S.D.A. 189, 280, 486, 686, 784, 886.
Marketing—*see also special products*.
agricultural products, effect of trucks, 883.
associations, cooperative, law of, 585.
Marketing—Continued.
Board, Empire, and agricultural economics, 79.
cooperative—
by national sales agencies, 85.
extension work in, U.S.D.A. 190.
in Finland, 79.
in United States, 79.
relation to Federal Farm Board, 79.
research in, 79.
direct, principles, 585.
principles, organization and policies, treatise, 683.
system, farmers' national, papers on, 585.
Markets—
organized commodity, treatise, 683.
public produce, in New York, survey, 79.
public produce, in up-state New York, N.Y.Cornell 783.
roadside, use, 585.
Maruca testulalis—
distribution, life history, and food plants, 457.
notes, 851.
Maryland—
Station, notes, 900.
Station, report, 99.
University, notes, 900.
Masicera senilis, parasite of corn borer, Ind. 152.
Massachusetts—
College, notes, 798.
Station, notes, 498, 798.
Station, report, 399.
Massarina usambarensis, notes, 344.
Mastitis—
detection, 259.
diagnosis and control, 670.
in cows, studies, 268.
infectious, control, Conn.Storrs 776.
of cattle, vaccine for, Mich. 772.
streptococcic, disturbance of udder secretion, 868.
streptococcic, paper on, 869.
studies, 70.
Materials, raw, international control, treatise, 386.
Matthiola crosses for doubleness, Calif. 723.
Maury, M. F., bibliography and biography, 509.
May beetles in Minnesota, effects of physical factors, 253.
Mayetiola destructor, *see* Hessian fly.
Maynard Ganga Ram Prize, notes, 800.
Mayonnaise salad dressing, analyses, Conn. State 789.
McCormick gift to American Society of Agricultural Engineers, 401.
Meadow mixtures, tests, Wyo. 127.
Meadows—*see also* Grasses, Grassland, and Pastures.
improvement, Nebr. 822.

Meal worm, yellow, hatching of eggs, 244.
Mealybug—
citrophilus—
biological control, Calif. 156.
on pears and apples, control, Calif. 753
parasites of, Calif. 755.
citrus, biological control, Calif. 156.
citrus, parasites of, Calif. 755.
parasite of, Calif. 756.
Mealybugs—*see also specific host plants.*
control, Hawaii.Pineapple Canners', 853.
in California, biological control, Calif. 156.
Meat—
curing, Tenn. 861.
digestibility, effect of cooking, 586.
home canning under Louisiana conditions, La. 488.
in nutrition, 288.
inspection, bacteriologic, methods of cultivation, 869.
marketing in 1931, 255.
meal tankage, feeding value, Iowa 163, 661.
poisoning due to *Bacillus suipestifer*, 472.
production, consumption, and foreign trade, statistics, U.S.D.A. 686.
research, 255.
scrap, supplement for poultry, amount, Ind. 167.
scrap v. skim milk as cottonseed meal supplements, S.C. 557.
Meats—*see also* Beef, Pork, *etc.*
cold storage holdings, U. S. D. A. 784.
fresh, frosted packages of, 585.
Media, *see* Culture media.
Medical dictionary, 566.
Mediterranean fever, *see* Undulant fever.
Melampsora lini, notes, 347.
Melanconium sacchari, notes, 344.
Melanin formation in eyes and hair of rabbits, 625
Melanogaster ampelophila, *see* Pomace flies.
Melanose on citrus, control, Fla. 438.
Melioidosis in a cow, 268.
Meliola butleri, notes, 344.
Melittia satyriniformis, *see* Squash vine borer.
Melon aphid—
life history, habits, and control, Va. Truck 156.
transmission of cucumber mosaic by, 237.
Melons—
culture in Oregon, frost forecasting service for, U.S.D.A. 808.
intercropping citrus with, Fla. 439.
marketing, Del. 783.
Membracidae of China, 546.
Menhaden oil—
comparison with cod-liver oil as to vitamin content, 397.
Menhaden oil—Continued.
feeding, effect on milk secretion and butterfat in cows, 663.
Meningo-encephalomyelitis of squirrels affected with coccidiosis, 271.
Menstrual cycle in monkeys, fertile period, 219.
Menstruation—
and anterior pituitary, 427.
basal metabolism during, 395.
effect of hypophysis, 29.
Meoneura obscurella larvae in snuff, 852.
Meracantha contracta in rotten stump, notes, Conn.State 451.
Mercury—
compounds for brown patch control, 44.
dusts, organic, for smut control, Mich. 745.
Mesoleius tenthredinis parasite of larch sawfly, 553.
Messor semirufus, activity, factors affecting, 852.
Metabolism—
basal, of Australian aboriginals, 892.
basal, of Filipinos, 292.
basal, of Maya Indians in Yucatan, 791.
of rats during prolonged fasting, 98.
relation to chromosome structure and duration of life, 725.
studies, 30.
Metals—
corrosion, and milk flavor, Calif. 262.
corrosion rate in vinegar, Calif. 709.
soluble in milk, Wis. 469.
Metaxenia in cotton, 423.
Meteorological—
observations, Fla. 414; Mass. 510; Me. 797; U.S.D.A. 15, 316, 414, 618, 807; V.I. 714; Wyo. 111.
observations at Lansing, Michigan, 111.
records, forty-year summary, Mass. 714.
Meteorology—*see also* Climate, Rainfall, Temperature, Weather, *etc.*
papers on, U.S.D.A. 15, 316, 618, 807.
treatise, 713.
Meters for farm equipment, 675.
Methemoglobin, crystalline, preparation and properties, 202.
Methylene blue reduction test—
modified, 866.
value in estimating keeping quality of milk, 373.
Mice—*see also* Rodents.
developmental anomalies in special strain, 725.
hereditary resistance to specific bacterial infection, 328.
interspecific cross of, inheritance in, 328.
interspecific cross of, stillbirths in, 328.
laboratory, origin, heredity, and culture, 650.

Michigan Station—
notes, 799.
quarterly bulletin, 496, 697.
report, 198, 797.
Microbracon hyslopi, parasite of seed caterpillar, 758.
Microbracon mellitor, notes, 453.
Microcalliphora varipes, notes, 551.
Microclimate and plant climate, treatise, 413.
Microlepidoptera of economic importance in Peru, 655.
Microorganisms—*see also* Bacteria *and* Organism.
assimilation of phosphorus by, 419.
biochemistry, 566.
in soil, treatise, 321.
Microscopy, chemical, handbook, 309.
Microthyriella rubi, notes, 644.
Microtus brandti in Mongolia, 244.
Milk—
abnormal, symposium, 259.
acidity tests, variations in, explanation, Wis. 468.
acidophilus, effect of storage temperature, Wis. 469.
acidophilus, preparation, Mich. 469.
agglutination titer as indicator of *Bacterium abortus* in, 265.
and cream supply of New York State, 865.
antirachitic value, effect of feeding irradiated yeast, 372.
bacteria, colon group in, 865.
bacteria, direct counting under microscope, new method, 324.
buffer value, variations in, 564.
cans and can washing, 865.
coagulation and proteolysis by *Streptococcus lactis*, variations, 564.
condensed, effect on ice cream mix, Mich. 769.
cooling, electrically-operated tanks v. ice, Mass. 372.
cost of production and farm organization, Vt. 579.
cream layer formation, N.Y.State 373.
cream layer, variations from different breeds, N.Y.State 373.
dry, inorganic constituents, variations in, 263.
dry, iron in, 290.
effect of freezing, Conn.Storrs 769.
effect of vitamin D treated feed, 399.
evaporated, bacteriological examination, 290.
evaporated, feathering in hot coffee, 689.
feeding, excessive, effect on gastric motility and relation to chronic anorexia, 694.
fever, cause, parathyroid deficiency theory, 267.
fever treatment, effect of calcium chloride injection, 472.
flavor, effect of corrosion of metals, Calif. 262.
Milk—Continued.
flavors, abnormal, 259, 866.
for manufacture of American cheese, standardization, Wis. 374.
fore, of cows, bacterial content, 261.
forms, calcium and phosphorus utilization, 290.
from cows on rations of different concentrations of calcium and phosphorus, effect, Calif. 768.
gargety, chemical studies, Conn.Storrs 769.
grade A, from farm to table, 866.
high quality, production, Vt. 664.
high quality, production, effect of delayed cooling, Vt. 564.
house, construction, Ill. 479.
human, vitamin potency, effect of yeast in maternal diet, 398.
irradiated, antirachitic action on rats, 398.
keeping quality, determination, 373; Vt. 562.
keeping quality, time and temperature test, 866.
market of Los Angeles, economic survey, Calif. 483.
natural, value, 666.
neutralization, detection, Wis. 468.
nutritive value, studies, Ohio 892.
odor and flavor from green feeds, Calif. 768.
of different animals, amylase content, 869.
of leading cattle breeds, vitamin A in, Nebr. 262.
ordinance, report, 866.
pasteurization—
electropure and holding methods, effect on bacterial endospores, 262.
in nickel container, effect on vitamins, 92.
lethal temperatures for *Brucella abortus* in, 265.
pasteurized at high temperatures, creaming, N.Y.State 866.
pasteurized, effects of thermophilic bacteria in, 865.
pasteurizing at 63 to 65° C., reliability test, 869.
phosphate number defined, 666.
plant practice, paper on, 865.
plant, soaker type washers in, 259.
plants, bacteriological and temperature studies, 865.
preparations, dried powdered, for infants, bacteriologic study, 693.
production—
clean, factors affecting, Mich. 769.
comparative advantage of New England and Middle West, 86.
effect of intermediate v. late soybean hay, Ind. 169.
effect of temperature, 371.
effect of water bowls in cattle stalls, Iowa 169.

Milk—Continued.
production—continued.
for New York market, N.Y.Cornell 284.
native hay for, Wyo. 171.
relation to color of cattle, 523.
relation to size of cow, 371.
products waste, disposal studies, 384.
quality, judging, 865.
ropy, detection, 259.
ropy, heat resistance of organisms, 565.
samples, preparing for methylene blue test, Vt. 469.
secretion, effect of hormone and mechanical stimulation, 260.
separated, feeding value for chicks, 257.
skimmed, *see* Skim milk.
soft-curd, Utah 689.
standards, higher, 866.
strainers, dry cotton discs for, efficiency, Mich. 664.
substitutes for calves, Iowa 65; Mass. 370.
sugar in milk, relation to blood sugar of cattle, 869.
supplies of large cities, factors affecting, 79.
supplies, quality improvement, 866.
supply of New Jersey metropolitan market, N.J. 83.
supply of Philadelphia, factors affecting, 79.
testing, laboratory technic, symposium, 259.
thermophilic bacteria in, Calif. 768.
titratable acidity, effect of dilution, 665.
unstable to heat, detection, 665.
variations in fat and solids-not-fat, 66.
vitamin E in, Wis. 459.
waste products, treatment, 882.
Milking—
machines, bacteriological investigations, 67.
machines, washing and sterilizing methods, Ind. 172.
mechanical, present status, 576.
Millet—
culture under dry-farming conditions, N.Mex. 527.
variety tests, N.Mex. 221.
vitamin G in, 93.
water requirements, 128.
Milo—
culture under dry-farming conditions, N.Mex. 527.
dwarf yellow, prolamins of, 10.
Mineral—
deficiencies of corn and soybeans, Ind. 158.
deficiencies of soil, Naubauer method for determining, 19.
metabolism of dairy cows, Vt. 561.
requirements of chicks, 257.
requirements of dairy cattle, Mich. 468.
requirements of heifers, Mass. 370.
Mineral—Continued.
supplements for pigs, 255; N.C. 164.
Minerals—
consumption by pigs, effect of place o feeding ear corn, 255.
for fattening steers, Iowa 159.
in leaves, effect of fertilizers, 25.
value in raising draft colts, Iowa 166
Mink, American, lung flukes in, 73.
Minnesota Station, notes, 300, 599.
Minnesota Station, report, 99.
Minnesota University, notes, 599.
Mississippi—
College, notes, 698.
Station, notes, 698.
Station, Raymond Branch, report, 99
Station, South Branch, report, 99.
Missouri Station, notes, 698.
Missouri University, notes, 698.
Mites—
and other animal pests of medical importance, relation to public health 244.
in greenhouses, Conn.State 451.
Pacific coast, notes, Calif. 753.
Mitochondria, variations of resistance tc osmotic action, 119.
Molasses—
baits for codling moth, 853.
cane, for fattening cattle, Minn. 365
estimation in mixed feeds, Tex. 615.
nicotine soap sprays, insecticidal value 50.
Molds, sterol production and antirachiti activatibility, 398.
Moles as predators of wireworms or click beetles, 551.
Molluscum contagiosum and fowl pox inclusion bodies, comparison, 270.
Monarthropalpus buxi, *see* Boxwood leaf miner.
Monetary conditions, relation to agricultural depression, 78.
Moniezia expansa, life history, 752.
Monilochaetes infuscans, control, N.C. 147.
Monkeys—
breeding and nonbreeding season in 219.
effect of vitamin deficiency, 92.
fertile period of menstrual cycle in, 219.
pathogenicity of *Brucella abortus* for, Mich. 174, 175.
period of gestation in, 220.
Monochamus quadrimaculatus on Siberian silver fir, 851.
Monothioethylene glycol, oxidation-reduction potentials, 204.
Montana College, notes, 698.
Montana Station, notes, 698, 900.
Moon blindness, etiology, 870.
Mosaic—*see also specific host plants*.
diseased plant tissues, cytological studies, 536.
diseased plants, scolecosomes and similar bodies in, 448.
diseases in West Africa, 645.

Mosaic—Continued.
- diseases, monochromatic light photography in study, 536.
- diseases, nature, 443.
- virus of grasses, not virulent to sugar-cane, 443.

Mosquito larvae—
- tissues, diamino acids in, 310.
- toxicity of rotenone and nicotine to, 846.

Mosquitoes—*see also* Anopheles, Culex, Malaria, *and* Yellow fever.
- aquatic animal and plant enemies, 250.
- collection in South China, 546.
- control, 656; Conn.State 451; N.J. 847.
- Control Institute, British, report, 361.
- house, biological races, 250.
- natural enemies in Colorado, 656.
- thermotropism in oviposition, 656.
- transmission of epithelioma contagiosa by, 250.
- transmission of fowl pox by, 876.

Moth borers, characteristics and distribution, 246.
Mothproofing materials, patented, index, U.S.D.A. 359.
Moths, owlet, on blueberries, Me. 757.
Motion pictures of U. S. Department of Agriculture, U.S.D.A. 688.

Motor—
- bus, impact reactions, U.S.D.A. 478.
- fuels, knock rating, 675.
- quarter horsepower portable, on the farm, 675.
- trucks, effect on marketing of agricultural products, 883.
- trucks, operation and production in concrete paving, 74.
- vehicle accidents in California, U.S.D.A. 478.
- vehicles, registrations and receipts, U.S.D.A. 478.
- vehicles, stopping, new regulations regarding, Conn.State 451.

Mower, new type, tests, 577.

Muck soils—
- celery growing on, N.Y.Cornell 137.
- experiment, Ind. 112.
- of Everglades, plant development in, rôle of copper, Fla. 417.
- of Sanpete Co., Utah 117.
- productivity, N.C. 114.
- studies, Mich. 719.

Mucor in soil flora, 320.
Mucosa of genital tract of cows, cyclic changes, 525.
Mules, statistics, U.S.D.A. 486.
Murgantia histrionica, *see* Harlequin bug.
Musca domestica, *see* House flies.
Muscoid flies, new North American species, Tex. 899.

Mushrooms—
- description and key, U.S.D.A. 138.
- sterol production and antirachitic activatibility, 398.

Muskmelon—
- mildew, control, Calif. 744.
- powdery mildew, nature and control, Calif. 143.

Muskmelons—
- marketing, consumer demand, Del. 783.
- variety tests, Ala. 434.

Muskrats, summary, 242.
Mutation, color, in mice, 425.

Mycobacterium tuberculosis—
- germicidal efficiency of orthophenylphenol, 671.
- susceptibility of gophers to, 570.

Mycogone nigra in alkaline soil, 321.
Mycology, field, treatise, 746.
Mycorrhizal fungus of Vaccinium, 520.

Mycosphaerella—
- *dendroides*, notes, Fla. 440.
- *gossypina*, notes, 646.
- sp., notes, 344.

Mycosphaerella disease, host range, Ala. 438.
Myosis, physostigmine and philocarpine, in equine and bovine, comparison, 870.

Myzus—
- *cerasi*, *see* Cherry aphid, black.
- *circumflexus*, notes, 248.
- *persicae*, *see* Peach aphid, green.
- *pseudosolani*, notes, 248.
- *pseudosolani*, transmission of plant viruses by, 853.

Nanophyes salmincola, notes, 72.
Narcissi, variety tests, N.C. 136.

Narcissus—
- bulbs, paper white, under different planes of nitrogen nutrition, N.J. 836.
- diseases, notes, 542.
- leaf yellow blotch disease, 542.

Narcosis, chloral hydrate, of horses, 567.
Nasal catheter for removal of bronchial mucus, 870.
Nasturtium mosaic, notes, 345.

National—
- Association of Marketing Officials, proceedings, 585.
- fruit and vegetable programs, 585.
- Livestock Marketing Association, program, 585.

Naval stores industry, practices and methods, U.S.D.A. 233.
Nebraska Station, notes, 498, 699.
Nebraska Station, report, 899.
Nebraska University, notes, 498, 699.
Necrology, notes, 800.
Negroes, migration from middle Georgia counties, 390.

Nematodes—
- control by clean fallow, Hawaii.Pineapple Canners' 650.
- eradication from greenhouse soil, Mass. 344.
- on pineapple plants, Hawaii.Pineapple Canners' 650.
- parasitic in poultry, developmental stages, U.S.D.A. 181.

Nematospora gossypii, notes, 646.
Nematus erichsonii, *see* Larch sawfly.
Nemeritis canescens, notes, 552.
Nemoura pekinensis, new species, 546.
Neolecanium cornuparvum, *see* Magnolia scale.
Neonicotine and isomeric pyridylpiperidines, 547.
Nephritis in dogs, cause, 567.
Netherland East Indies, handbook, 388.
Nevada Station, notes, 100, 599, 900.
Nevada Station, report, 797.
New England Research Council on Marketing and Food Supply, proceedings, 85.
New Hampshire—
 Station, notes, 200.
 University, notes, 200, 498.
New Jersey—
 Mosquito Extermination Association, meeting, 656.
 Stations, notes, 100, 200, 498.
 Stations, report, 899.
New Mexico Station, report, 299.
New York—
 Cornell Station, notes, 200, 499.
 State Station, notes, 100, 599, 699, 799.
 weevil, injury to apple trees, Conn. State 451.
Nickel—
 solubility in milk, Wis. 469.
 sulfide, quantitative precipitation, 615.
Nicotiana—
 chromosomal aberrants and gene mutations in, 121.
 hybrid, fertile triple, studies, 521.
Nicotiana rustica—
 fertilizer experiments, 632.
 nicotine in and yield, factors affecting, 632.
Nicotiana tabacum—
 fertilizer experiments, 632.
 X-rayed sex cells, variant plants produced from, 625.
Nicotine—
 and potassium oleate, insecticidal value, 50.
 and rotenone, relative toxicity to *Aphis rumicis* and mosquito larvae, 846.
 concentrations in tobacco, effect on fowls, 382.
 insecticides, analyses, 651.
 molasses soap sprays, insecticidal value, 50.
 sulfate sprays v. pyrethrum sprays for bean jassid, Fla. 451.
 tannate, corrective and sticker for, 847.
 tannate v. lead arsenate for codling moth control, 55.
 use against poultry parasites, 675.
Nightshade, poisonous to livestock, Ind. 70.
Nitrate nitrogen—
 absorption by plants at different growth stages, 322.
 in market garden soils, 514.
Nitrate nitrogen—Continued.
 of soil and vegetable crops, R.I. 511.
Nitrate of soda, *see* Sodium nitrate.
Nitrates—
 assimilation in soils, Iowa 20.
 in plant juices, R.I. 512.
Nitrification—
 in Nebraska soils, Nebr. 809.
 in soils, problem, 418.
Nitrites—
 effect on iodine-starch reaction, 813.
 production in soils, Tex. 813.
Nitrogen—
 availability in various fertilizers, N.J. 811.
 availability, vegetation pot experiment for study, Mass. 22.
 carriers, spring top-dressing experiments with, Ind. 124.
 combined, effect on growth and nitrogen fixation by Azotobacter, 211.
 deficiency, buckwheat as indicator crop, R.I. 512.
 effect of chloroplast pigments, 25.
 effect on yield and nicotine in *Nicotiana rustica*, 632.
 excessive, effect on wheat leaf rust susceptibility, Ind. 143.
 fertilization, effect on carbohydrates in apples, 229.
 fixation—
  by Azotobacter, effect of combined nitrogen, 211.
  by *Rhizobium trifolii* on red clover plants, Wis. 422.
  by symbiotic bacteria, Hawaii. Pineapple Canners' 813.
  relation to leguminous and nonleguminous crops, Mass. 318.
  relation to leguminous crops, Mass. 317.
 forms in plant materials, effect of storage, Ind. 108.
 in apple trees, distribution and fluctuation, 229.
 in cotton plant, 630.
 in farm manure, availability under field conditions, 515.
 in farm manure, conservation and availability, 514.
 in soil, effect of Austrian winter peas, 322.
 in soil, effect of climate, Mo. 20.
 lime, *see* Calcium cyanamide.
 organic and inorganic, for cotton, N.C. 131.
 residual, in blood of equines and bovines, 568.
 source for tubercle bacilli cultures, 773.
 sources, comparison, Miss. 126.
 sources, effect on grasses, Mass. 330.
 sources for tobacco, Conn.State 335; Mass. 337.
Nitrogenous—
 compounds in solution, effect of *Rhizobium* spp., 418.

Nitrogenous—Continued.
fertilizers, effect on peas, N.J. 839.
fertilizers, relative value, N.J. 621.
materials, availability studies, N.J. 816.
substances, ammonification by pure cultures of microorganisms, 720.
Nitrous acid, effect on vitamins B and G, 311, 612.
Noctuid larvae, tarsal claws, Me. 797.
Nodular worms, anthelmintics for, tests, 874.
Nodule bacteria—
growth on nitrogen-rich medium, changes in, Wis. 422.
in commercial legume cultures, Wis. 431.
isolating from other soil organisms, Wis. 422.
Nodule formation induced by *Rhizobium* spp., variation, 443.
North Carolina Station, report, 198.
Nosema disease, dissemination, 568.
Notocotylus gibbus, notes, 353.
Novius cardinalis—
in Spain, propagation, 651.
predator, of cottony cushion scale, 248.
Nucleic acid and dye, stoichiometrical relations, 202.
Nucleus—
behavior during cell division in root-tip of Thespesia, 520.
of pollen mother-cell of Thespesia, prophase, 521.
Nursery—
inspection, Conn.State 451.
stock, disease-free, production, rules and regulations, 834.
stock, imported, inspection, Conn.State 451.
transplants, mulching, 342.
Nutrient media, *see* Culture media.
Nutrient requirements for dairy cattle, 466.
Nutrition—*see also* Diet.
and diet therapy, textbook, 890.
and food chemistry, treatise, 392.
animal, *see* Animal nutrition.
factor, new, 292.
of mother, relation to birth weight of young, 691.
plant, *see* Plant nutrition.
relation of manganese to, 192.
studies with poultry, N.J. 863.
teaching, old and new emphases in, 292.
Nylanderia bourbonica in Florida, 58.
Oak—
galls, cynipid in, biology, 657.
leaf rollers, abundance, Conn.State 451.
leaf rollers, control, 50.
Oaks, positive gas and water pressure in, 423.
Oat—
diseases, notes, 345.
feed as hay substitute for horses, Wis. 462.
Oat—Continued.
hay, nutritive value, effect of leaching, Calif. 658.
rust, physiologic forms, Iowa 145.
seed, germination, effect of disinfectants, 44.
smut, control, N.C. 146.
smut, new dust treatments for, 235.
smut resistant varieties, Mich. 149.
spot blotch, control, Mich. 745.
stem rust, notes, Mich. 149.
Oats—
acreage survey, Iowa 125.
as hay crop, Ala. 331.
as tobacco cover crop, Conn.State 335.
breeding, Nebr. 822.
Columbia, new variety, Mo. 332.
culture experiments, Nebr. 822.
effects of various plant foods, 826.
fall-sown, spring tillering, 825.
feeding value, 254.
feeding value for lambs v. cattle, Ind. 159.
fertilizer experiments, Fla. 429; Miss. 31; Nebr. 822; Wyo. 127.
grinding, value for cattle and lambs, Ind. 160.
hybrids, notes, Calif. 728.
improvement, N.J. 824.
in Northeastern States, U.S.D.A. 132.
Iogold, stem rust resistant variety, Mich. 729.
lodging in, Ohio 129.
preparation for pigs, Oreg. 861.
production in western Oregon, Oreg. 731.
seeding experiments, Idaho 222.
strains grown in rod-row trials, statistical study, 626.
stunting disease, 645.
v. corn for nursing ewes, Ind. 159.
variations in local prices, Mo. 485.
varieties, Colo. 35.
varieties for cut-over land, Idaho 222.
varieties for northeastern Wyoming, Wyo. 731.
varieties, registered, standard descriptions, 529.
variety tests, Miss. 31; N.C. 126; N.Mex. 221; Nebr. 432, 822; Utah 222, 627; Wyo. 127.
vitamin A in, 397.
vitamins B and G in, Ill. 589.
water requirements, 128.
wild, nutritive value, effect of leaching, Calif. 658.
with vetch or peas, yields, Calif. 727.
yields, effect of plowing time, Wyo. 127.
Oberly Memorial Prize, notes, 800.
Obesity—
metabolism of, 695.
nature of, 793.
Oecanthus—
californicus, studies, Calif. 53.
niveus, *see* Cricket, snowy tree.

Oestrin—
injections, effect on dogs, 30, 427.
relation to oestrous cycle, 30.
Office of Experiment Stations—
new chief, editorial, 701.
notes, 300.
Ohio State University, notes, 300, 499.
Ohio Station, notes, 499, 699.
Oidium—
evonymi japonicae conidia, germination, 442.
quercinum conidia, germination, 442.
Oil—
cakes, use for bacon production, 555.
emulsion, white, for European elm scale, 456.
from rubber seed, characteristics, 410.
in cottonseed, variation during growth, 631.
mineral, effect on absorption and utilization of vitamin A, 793.
seeds, Indian, studies, 530, 817.
sprays—
effect on foliage, N.J. 849.
effect on satsuma oranges, Ala. 450.
experiments, Mo. 340.
for dormant use, Wash.Col. 154.
for San Jose scale control, N.Mex. 245.
for summer use, Wash.Col. 652.
notes, Mass. 358.
selection and compatibility, Conn. State 451.
Oils—*see also* Fats *and specific oils.*
antioxygenic substances, chemical nature, 205.
lubricating, detonation as affected by, 76.
miscible, as sprays, efficiency, Mass. 353.
penetration into plant tissues, N.J. 849.
Okra, vegetative growth, Oreg. 738.
Olive fly, studies, 546.
Olive oil, absorption curves of acids, 805.
Olives—
canning, notes, Calif. 709.
oil in, factors affecting, Calif. 709.
production and utilization, Calif. 189.
Olpidiaster radicis, notes, 540.
Olpidium radicicolum f, notes, 345.
Olpidium radicicolum on cruciferous plants, 539.
Onion—
disease resistance, relation to pigmentation, 327.
maggot, attrahent bait for, Iowa 153.
maggot, oil sprays for, Mich. 153.
mildew, notes, 345.
pink root disease, susceptibility of inbred lines, Calif. 745.
seeds, Fusarium attack on, 237.
thrips, notes, Mass. 354.
thrips, relation to pineapple yellow spot disease, 548.
Onion—Continued.
thrips, transmission of pineapple yellow spot, Hawaii.Pineapple Canners' 852.
yellow dwarf disease, control, Iowa 145.
Onions—
Bermuda, yields, V.I. 737.
cooperative cultural and varietal tests, N.Mex. 227.
cultivation experiments, N.Y.Cornell 635.
Early Grano, culture, N.Mex. 534.
fertilizer experiments, Mass. 338.
pigmentation in, genetic factors, 327.
shipments to New York City, returns from, V.I. 737.
utilization by canning, Mass. 315.
vitamin B complex in, 590.
yield, effect of Bordeaux mixture, Mass. 343.
yield, effect of source of potash, R.I. 526.
Onthophagus granulatus in stomach of domestic animals, 551.
Oogenesis in ground squirrel, 218.
Oospora scabies, *see* Potato scab.
Ophiobolus graminis, notes, 345.
Ophiola striatula, notes, Mass. 357.
Ophthalmoscope, neukla, paper on, 869.
Opuntia dillenii, *Pythium aphanidermatum* on, 240.
Orange—
breakdown, Calif. 743.
diseases, notes, 345.
ice, use of honey in, 488.
leaves, sap concentration and inorganic constituents, Calif. 232.
mottle leaf, effect of iron sulfate, Calif. 735.
rinds, chlorophyll-decomposing enzyme in, Ala. 437.
tortrix, control, Calif. 756.
trees, bark scaling and exfoliation, Fla. 438.
trees, boron-deficient, anatomical and physiological changes in, Calif. 150.
trees, growth, effect of rootstock, Calif. 734.
trees, Washington Navel, brushing out experiments, 640.
wither tip, notes, 344.
Oranges—
culture in South Africa, 42.
effect of potash, Fla. 434.
Pineapple, measurements, Fla. 434.
sour, seed germination, Fla. 434.
vitamin C in, Hawaii 793.
Orchard—
fruits, lepidopterous enemies, 651.
inspection, *see* Nursery inspection.
pollination, relation to bees, N.J. 849.
Orchards—*see also* Fruits, Apples, Peaches, *etc.*
windbreak experiments, Okla.Panhandle 841.

Orchid seed germination, physiological studies, 119.
Oregma lanigera, biological control, 355.
Oregon College, notes, 599, 699.
Oregon Station, notes, 200, 699.
Organic matter—
 and pineapple production, Hawaii.Pineapple Canners' 640.
 as factor in orchard fertility, Pa. 229.
 for soil, sources, R.I. 511.
 in New York State soils, 620.
 in soil—
  accumulation, relation to carbon-nitrogen ratio, 514.
  and temperature relations in eastern United States, 513.
  base exchange properties, 417.
  determination, 504.
  effect of Austrian winter peas, 322.
  effect of climate, Mo. 20.
 types of, effect on soil properties, 813.
Organic substances, effect on iodine-starch reaction, 313.
Organism—*see also* Bacteria *and* Microorganisms.
 concept, 623.
Orgilus mellipes, parasite of seed caterpillar, 758.
Oriental peach moth, *see* Peach moth.
Ornamental plants and shrubs, *see* Plants *and* Shrubs.
Ornithodoros turicata—
 notes, 266.
 transmission of relapsing fever by, 657.
Orobanche cernua, notes, 345.
Orthophenylphenol, germicidal efficiency against *Mycobacterium tuberculosis*, 671.
Orthoptera of Vancouver Island, 355.
Oscinella frit, nematode parasite of, 360.
Osmoderma socialis, nervous system, 546.
Osmotic—
 pressure, effect on growth, transpiration, and storage of ashes in tobacco, 213.
 quantities of plant cells, 119.
Osteomalacia, studies, 398.
Otiorhynchus cribricollis, notes, 657.
Ova, extratubal, in albino rats, 219.
Ova in rats, intra-uterine migration, 218.
Ovarian—
 cycle, regulation, 626.
 hormones, effect on mammary growth and milk secretion, 329.
Ovariectomy and transplantation, effect on pregnant albino rats, 427.
Ovaries—
 of cows, changes in during pregnancy, 525.
 relation to maintenance of pregnancy, 427.
Oven utensils, speed and efficiency, 697.
Ovens used for domestic cooking, Ind. 196.
Ovulation in rabbits—
 humoral mechanisms concerned in, 28.
 quantitative study, 28.

Oxidase activity of fruit, factors affecting, 214.
Oxytofactor, use of term, 651.
Oyster drill snails—
 salinity death-points, 243.
 trapping, N.J. 243.
Oyster—
 larvae, movements and distribution, N.J. 751.
 problems in Barnegat Bay, N.J. 751.
Oysters, diamino acids in, 310.
Oyster-shell scale, control, Mich. 456.
Pachyscheius psychotriae n.sp., description, 657.
Paddy fly in Ceylon, control, 247.
Pagoda tree, fruiting sprays, insect inhabitants, 546.
Paint—
 hiding power measurement, 76.
 service on wood, evaluation, 76.
Paints—
 cold water, value as wood protectors, Mich. 778.
 sheep branding, scouring out of wool, Wyo. 195.
Palm, coconut, *see* Coconut.
Pammel, L. H., editorial note, 101, 105, 107.
Pandorus sphinx, notes, Conn.State 451.
Pangaeus uhleri on spinach seedlings, 455.
Panolis flammea, studies, 852.
Papaipema nitela, *see* Stalk borers.
Papaya fruit fly, notes, 50.
Paper—
 decomposing, effect on plant growth, Mass. 318.
 mulch incorporation in soil of tomato seedlings, effect, Mass. 339.
 mulch tests, Can. 825.
 mulch, value to crops, Fla. 435; Ohio 435.
 pulp, *see* Pulpwood.
Papuana semistriata on coconut palms, 58.
Parabiosis of Leghorn fowls, 220.
Paradichlorobenzene—
 as fumigant for clothes moths, 457.
 for peach borer control, Mich. 456.
 oil emulsion tests for San Jose scale, 50.
Paraffin hydrocarbons, detonation characteristics, 274.
Paragonimus kellicotti in American mink, 73.
Paralecta antistola, notes, 547.
Paralysis—
 of fowls, Fla. 475.
 of fowls and roup complex, 270.
 of fowls, cause, Mich. 772.
 of fowls, lesions associated with, 73.
 of nutritive origin in chicks, 559.
 range, of chickens, 877.
 tick, and tick toxin, 773.
Paramonostomum parvum n.sp., description, 353.
Parasites—*see also specific forms*.
 action on chondriome-plastidome, 119.
 and predators of insect pests, papers on, 756.

Parasites—Continued.
biochemic specificity, 253.
cooperation in work around Pacific, 756.
hymenopterous, studies, 552.
of cultivated plants, 756.
oxyurid, of scarabaeid larvae, description, 361.
relation to animal husbandry, 253.
use, overlooked suggestion, 50.
Parasitism, physiological aspects, 442.
Parasitylenchus scolyti n.sp., description, 551.
Paratetranychus ununguis, notes, Mich. 153.
Paratettix texanus, parthenoproduced, chromosomes, 217.
Parathyroid—
deficiency theory of cause of milk fever, 267.
glands of chicks, development, effect of radiant energy, 463.
Paratrioza cockerelli, relation to a new potato disease, 238.
Paratuberculosis, *see* Johne's disease.
Paratyphus of calves, pathological anatomy, 567.
Paresis, parturient, *see* Milk fever.
Parrot disease communicable to man, 471.
Parsley yellows, transmission, Calif. 753.
Partridge, Hungarian, parasite of, 878.
Pasteurellosis in mice, 773.
Pasteurization, *see* Milk.
Pasture—
crops for producing market lambs, Ind. 61.
crops under drought conditions, tests, Mich. 634.
grass, composition and yield, Vt. 561.
land, white grubs in, Wis. 452.
Pastures—*see also* Grasses, Grassland, *and* Meadows.
carrying-capacity tests, Nev. 761.
cost, Ind. 185.
fertilization, Mich. 718.
fertilization and management, 527.
fertilizer experiments, Fla. 429; Mass. 330; N.J. 824.
improvement, Conn.Storrs 727.
irrigated, effect of different grazing systems, 821.
lowered productivity, causes, Wis. 431.
management for dairy cattle, N.C. 170.
permanent, for fattening pigs, value, N.C. 165.
studies, Fla. 429; Miss. 31; Tenn. 825, 856.
tame v. native, Okla.Panhandle 362.
temporary, comparison for sheep, N.C. 160.
Pea—*see also* Peas.
aphid, life history, habits, and control, Va.Truck, 156.
diseases, notes, 345.
nematode, notes, 345.
vine hay v. alfalfa hay for cows, Wis. 466.
Pea—Continued.
vine silage and hay for lambs, Wis. 460.
weevils, notes, 246.
wilt resistance, notes, Wis. 446.
Peach—
aphid, green—
life history, habits, and control, Va.Truck 156.
rôle in potato leaf roll, 757.
vector of virus of breaking in tulips, 247.
borer, control, Mich. 456.
drops, burying for plum curculio control, 453.
foliage, poisonous to livestock, Ind. 70.
moth, oriental—
bait-trapping experiments, 249.
control, 55; Ind. 52.
habits, 56.
insecticides for, tests, 55.
larval parasites of, N.J. 54.
lead arsenate v. fluorine compounds for, Tenn. 851.
notes, Mich. 153.
parasite, mass production and distribution, 59.
parasite work in Connecticut, 56.
relation to *Chrysopa oculata*, 655.
studies, Conn.State 451; Ind. 152; N.J. 848.
peroxidase, inactivation temperature, effect of pH, 214.
root knot, studies, Tenn. 840.
rosette, transmission experiments, Ga. 142.
seedlings developed by station, Iowa 135.
seedlings, tests, N.J. 831.
trees, effect of additional nitrogen, N.C. 136.
trees, nitrogen sources, relative value, correction, Del. 436.
Peaches—
blooming dates, N.J. 832.
breeding, N.C. 136.
California clingstone, suitability for Michigan, Mich. 436.
cold resistance and fruit setting, N.J. 832.
delayed foliation, Calif. 723.
Diplodia spp. affecting, Fla. 439.
effect of late thinning, Calif. 735.
frozen, vitamins in, Ga. 192.
fruit development period, N.J. 41.
marketable and cull, records, Ga. 184.
pollination requirements, 41.
pruning, N.C. 136.
value of spreaders in sprays, Mo. 340.
variety tests, Mass. 340; Miss. 39.
Peanut—
farms, organization, relation to hog production, Ala. 480.
leaf spot, notes, Ga. 142.
plants, upper cell wall, calcium oxalate crystals in, N.C. 118.

Peanuts—
breeding, 225; Fla. 429; N.C. 126.
culture, N.C. 126; U.S.D.A. 225.
experiments, Ark. 633.
feeding value for steers, Ga. 159.
fertilizer experiments, Fla. 429; N.C. 126.
spacing tests, N.C. 126.
variety tests, N.C. 126.
Pear—
blight, insect transmission, Calif. 753.
blight, new hosts, Calif. 744.
fire blight, control, Tenn. 840.
fire blight resistant varieties, 351.
fruits, stone cells of, Mich. 739.
midge, studies, 56.
peroxidase, inactivation temperature, effect of pH, 214.
scab, notes, 345.
scab, spraying experiments, 351.
scald and Anjou scald, differentiation and control, Oreg. 750.
shoots, nitrogen in, seasonal changes, 639.
trees, rootstocks of, identification, Calif. 736.
Pears—
baking, Oreg. 787.
freezing injury, variation, Oreg. 535.
fruit size and quality, relation to foliage, Wash.Col. 138.
in bushel baskets, cold storage holdings, U.S.D.A. 784.
in cold storage, peculiar freezing trouble, Oreg. 750.
insect and mite enemies, Mich. 652.
on tree and in storage, composition, 833.
pollination experiments, 636.
pollination requirements, 41.
seedling, winter hardiness studies, Iowa 135.
table, varieties, 230.
varietal and cultural notes, Fla. 435.
Peas—
Ascochyta affecting, Ala. 437.
Austrian winter—
as green manure, 322.
as hay crop, Ala. 331.
breeding, Tenn. 825.
culture and uses, Oreg. 826.
canning, quality, factors affecting, N.Y.State 635.
canning, rogues in, origin and nature, Wis. 435.
culture under dry farm conditions, Utah 627.
effect of calcium deficiency, 216.
effect of length of day, Mich. 722.
effect of nitrogen fertilizers, N.J. 839.
fertilizer experiments, Miss. 39; Wis. 435.
seeding experiments, Idaho 222.
shipments from Florida and competing areas, Fla. 886.
varieties for cut-over land, Idaho 222.
Peas—Continued.
variety tests, Ala. 434; Mass. 330; Miss. 39.
vitamin A in, seasonal variation, Mich. 793.
with oats, yields, Calif. 727.
Peat—
land hay as roughage for cattle, Minn. 365.
soil, durability of concrete tile in, Wis. 477.
soil temperatures, relative to summer frosts, 509.
soils, fertilizers for, Iowa 113.
soils of Everglades, plant development in, rôle of copper, Fla. 417.
soils, sugar beets on, Calif. 728.
Pecan—
leaf injury, notes, Fla. 440.
leaf spot, new, notes, 241.
rosette, notes, Fla. 440.
scab, notes, Fla. 440.
weevil, life history studies, Ala. 450.
Pecans—
cover crops for, Fla. 435.
fertilizer experiments, Ala. 434; Fla. 435.
flowering habit, Ga. 141.
fruit setting in, 232.
fruiting, relation to terminal growth, 835.
nut case-bearer injury, Fla. 452.
variety tests, Miss. 39; N.Mex. 227.
yield and quality, effect of fertilizers, 835.
Pectin extraction, effect of temperature, Del. 407.
Pectinophora gossypiella, see Bollworm, pink.
Pediculus humanus capitis, control, 453.
Pegomyia brassicae, see Cabbage maggot.
Pelargonium zonale leaf disease, capsid associated with, 247.
Pellagra, relation to vitamin G deficiency, 93.
Penicillium—
biochemistry, 566.
corm rot of gladioli, 542.
in soil flora, 320.
Penicillium sp., notes, 344.
Pennsylvania—
College, notes, 400, 499, 700.
Station, notes, 499, 700.
Pentosans, storage in seeds, Iowa 119.
Peonies, nonblooming, cause, Mich. 745.
Peony diseases, N.J. 852.
Pepper—
fruit rot, notes, Ga. 142.
maggot, notes, N.J. 849.
mosaic, seed transmission, N.J. 839.
weevil, notes, N.Mex. 245.
weevil, studies, Calif. 754.
Peppers—
effect of paper mulch, R.I. 584.
insects affecting, 651.
paper mulch experiments, Ohio 485.

Peppers—Continued.
pimiento, resistance to *Sclerotium rolfsii*, Ga. 142.
shipments, Fla. 481.
shipments from Florida and competing areas, Fla. 886.
shipments to New York City, returns from, V.I. 737.
Periarteritis nodosa in bovines, 870.
Perishable Agricultural Commodities Act in operation, 585.
Peritonitis of sheep, cause, 472.
Permeability—
of plant integuments for ions, 213.
of soils, N.Mex. 211.
Peronospora—
schachtii, notes, Calif. 744.
schleideni, notes, 345.
Persimmon trees, training, Calif. 736.
Persimmons, Japanese, culture in Florida, 288.
Pest control by Trichogramma, complications, 856.
Pestalotia spp., pathogenicity, N.J. 841.
Pestalozzia palmarum, notes, 344.
Pestalozzia sp., notes, 344.
Pests injurious in Mongolia, Soviet expedition for controlling, 244.
Peterboro Swamp and Labrador Pond areas, biological reconnaissance, 545.
Petroleum oils, saturated, use as insecticides, 358.
Phagocarpus permundus, notes, 246.
Phalacrocera vancouverensis, notes, 355.
Phalaris spp., identification, 529.
Phanaeus vindex, notes, U.S.D.A. 181.
Phenacoccus gossypii, biological control, Calif. 156.
Phenol coefficient tests for germicidal activity, limitations, 377.
Phenological observations in British Isles, 809.
Phenylglyoxal, synthesis, 711.
Phlebotomus spp. in Italy, studies, 361.
Phlegethontius—
quinquemaculata, insecticide efficiency for, 357.
sexta, *see* Tomato worm.
Phleum pratense, intersterile groups, genetics of, 121.
Phloeosinus dentatus infestation, relation to lowered tree vitality, 454.
Phlox, perennial and annual, diseases, N.J. 352.
Phlyctaenia ferrugalis, *see* Greenhouse leaf tyer.
Pholus pandorus, notes, Conn.State 451.
Phoma—
betae, notes, N.J. 839.
lavandulae, studies, 649.
lingam ?, notes, 345.
pitya and *P. abietina*, identity, 751.
Phoma in soil flora, 821.
Phomopsis—
conorum in Great Britain, 543.
pseudotsugae and *P. conorum*, differentiation, 543.
Phomopsis—Continued.
pseudotsugae, relation to *Phoma* spp., 751.
vexans, control, N.J. 838.
Phorbia cepetorum, *see* Onion maggot.
Phosphate—
fertilizers, value for apples, 699.
of blood plasma of dairy cows, relation to calcium, 261.
rock, effect on calcium retention of pigs, 366.
rock, v. bone meal for dairy cattle, Mich. 766.
Phosphates—
availability and efficiency, Ind. 112.
deficiency in Montana soils, Mont. 19.
in blood, effect of vitamin B deficiency, 95.
natural soft, composition, 420.
soil, availability, determination, 506.
vegetation pot experiment for study, Mass. 23.
Phosphatic materials, reactions, 420.
Phosphorus—
assimilation by soil microorganisms, 419.
availability in rice soils, effect of irrigation, 212.
balance of heavily milking cows, 260.
deficiency, turnips as indicator crop, R.I. 512.
determination, Deniges colorimetric method, Calif. 708.
determination, method of oxidizing and dissolving soil for, 312.
effect on chloroplast pigments, 25.
effect on wheat leaf rust susceptibility, Ind. 143.
elementary, effect on rickets, 695.
metabolism, effect of irradiated ergosterol, 95.
metabolism in chickens, 877.
ration, low, effect on dairy heifers, Mich. 766.
requirements of growing chicks, 557.
retention, effect of cellulose in vegetables, 91.
sources, comparison, Miss. 126.
spectrophotometric microdetermination, 313, 806.
utilization from various forms of milk, 290.
Phosphotungstic acid, precipitation of basic substances by, effect of pH, 501.
Phthorimaea operculella, *see* Potato tuber worm.
Phyllocoptes quadripedes, control, N.Y. Cornell 53.
Phyllophaga futilis, notes, Iowa 153.
Phyllophaga, physical ecology, 253.
Phyllosticta caryae, notes, Fla. 440.
Phyllotreta aerea, notes, Mich. 153.
Phyllotreta, parasites of, 552.
Phylloxera vastatrix, *see* Grape phylloxera.
Phymatotrichum root rot, studies, Tex. 841.
Physalospora disease of basket willow, 544.
Physalospora miyabeana, notes, 544.

Physics of the earth, III, meteorology, 713.
Physoderma zeae-maydis, notes, Fla. 439.
Phytalus smithi on sugarcane, 361.
Phytomonas—
berberidis n.sp., description, 750.
citri, studies, Fla. 438.
insidiosum, notes, Calif. 727.
vignae, overwintering, Mich. 746.
Phytonomus—
posticus, *see* Alfalfa weevil.
variabilis, notes, 651.
Phytophaga destructor, *see* Hessian fly.
Phytophaga sp., notes, Mich. 153.
Phytophthora—
cactorum, notes, N.J. 839.
hibernalis, notes, 345.
infestans—*see also* Potato blight, late.
zoospores, action of chemicals on, 539.
nicotianae, studies, 350.
pini antirrhini n.var., notes, 241.
sp., notes, 441.
spp., notes, 344.
spp., paragynous antheridia, 541.
Phytophthora genus, taxonomy, Mo. 841.
Pickle worm in chayote in Porto Rico, 851.
Pig houses, portable cot v. central house, Mich. 762.
Pig industry, Canadian, and lessons for the "Old Country," 662.
Pigeon pox—
immunization, 381.
Lahaye vaccine for, 675.
Pigeons—
host of spirurids, U.S.D.A. 182.
infection with *Bacillus aertrycke*, 574.
maintenance nutrition, relation to torulin, 593.
new dilution factor in, 327.
Pigments—*see also* Anthocyanins *and* Color inheritance.
development in cattle embryos, 524.
formation in eyes and hair of rabbits, 625.
hiding power measurement, 76.
pure, of plants, and Tswett adsorption method, 216.
Pigs—*see also* Sows *and* Swine.
and forage crops, 662.
breeders' annual, 662.
breeding and feeding, 662.
breeding, effect of deficiencies in rations, 63.
breeding experiments, Calif. 762; Ohio 820.
breeding in Irish Free State, 662.
calcium retention, effect of calcium fluoride and phosphate rock, 366.
composition of body fat, effect of ration low in fat, 555.
cramp and lameness in, 662.
dentition as indication of age, 662.
East Anglian, recording scheme, 584.
effects of feeding cows' milk, 662.
embryology, treatise, 556.
fattening, best nutritive ratio for, Wis. 461.
Pigs—Continued.
fattening, modifications of Big Ten supplement, Iowa 163.
fattening on soybean forage, S.C. 661.
feeding, Nebr. 860.
feeding and breeding experiments, Can. 60.
feeding experiments, Ga. 161; Ind. 162; Iowa 163; Mich. 164; N.C. 164; N.J. 860; Nev. 763; Ohio 166; Wyo. 166.
feeding experiments with oil cakes, 555.
government grades, comparative yields, 255.
growth and development, relation to preparation of rations, 461.
increase in prices, Iowa 185.
inheritance in, 327.
judging in Sweden, 662.
lameness in, cause, N.C. 166.
marketed by trucks, percentage, Iowa 185.
marketing, shrinkage in, Ind. 163.
need for out of doors, Ind. 162.
parasites, control, Ga. 162.
pasture, studies, Tenn. 857.
performance record, Iowa 63, 164.
predicting gains in, 759.
prices, 662.
production in South Africa, 662.
raising in Philippines, 64.
raising, Missouri plan, 555.
raising to weaning age, feed cost, Ala. 460.
rate of gains relation to carcass quality, Wis. 461.
self-feeders for, construction and use, Wis. 64.
sex ratio in, factors affecting, 526.
statistics, U.S.D.A. 486.
suckling, growth, 254.
variations in local prices, Mo. 485.
yield of wholesale cuts, determining, Ind. 162.
Pigweed, water requirements, 128.
Pilocarpine, antagonism on gravid uterus of bovine, 869.
Pimeliaphilus sp., notes, Conn.State 451.
Pine—
and spruce, growth differences on poor soil, 342.
Corsican, timber, properties and uses, 643.
geometrid, parasites, 852.
hardiness studies, Ind. 141.
leaf scale, control, N.Y.Cornell 53.
noctuid, studies, 852.
Norway, seed collecting, new principle, 643.
oil derivatives as adjuncts in contact insecticides, N.J. 849.
plantations on sandy soil, 233.
red, plantations, determining site quality, 742.
red, pruning in young plantations, 337.
seed, longleaf, storage, 233.

Pine—Continued.
  shoot moth, European, control, Conn.State 451; N.J. 850.
  slash, growth in Texas, 233.
  tar oil, refined, as insecticide and *fungicide*, 846.
  tree treasures, U.S.D.A. 233.
  27-year-old jack, thinning results, 837.
  western yellow, taper study, Calif. 742.
  western yellow, variation of crown *lengths or widths and stand density*, 837.
Pineapple—
  industry in Formosa, Hawaii.Pineapple Canners' 835.
  parasites and saprophytes, heat resistance, Hawaii.Pineapple Canners' 844.
  plants, decomposition rate, Hawaii.Pineapple Canners' 622.
  residues as green manure, value, Hawaii.Pineapple Canners' 640.
  residues, composting, Hawaii.Pineapple Canners' 622.
  roots, development of root knot nematode in, Hawaii.Pineapple Canners' 844.
  soils, analyses, Hawaii.Pineapple Canners' 620.
  yellow spot, effect of tobacco dust, Hawaii.Pineapple Canners' 844.
  yellow spot, onion thrips as vector, 548; Hawaii.Pineapple Canners' 852.
Pineapples—
  anatomy and effect of close planting, Hawaii.Pineapple Canners' 835.
  hybrid, characteristics of canned fruits, Hawaii.Pineapple Canners' 641.
Pink bollworm, *see* Bollworm, pink.
Pinworms in man, control, Mich. 772.
Piper betel wilt, notes, 441.
Piroplasma in poultry in Egypt, 475.
Piroplasmosis—
  bovine, in Central Russia, 870.
  bovine, in Germany, 870.
  in Egyptian fowls, 877.
Pituitary—
  body and gonads, relation, 29.
  extract, effect on lactating mammary gland, 329.
  gland secretions, rôle in menstruation, 427.
  injections, responses of rat gonads to, 427.
Pityophthorus and allies in North America, revisional study of genus, 551.
Plagiognathus repetitus, notes, Mass. 357.
Plant—
  ash, acid-base balance, R.I. 512.
  buffering systems, Calif. 708.
  bug, green, of Schilcher vine in Styria, 851.
  cell plasts, variations of resistance to osmotic action, 120.
  cell wall structure, N.C. 119.
Plant—Continued.
  cells—see also Cell.
    osmotic quantities, 119.
    turgor and movement, effect of pH, 213.
  chromosomes, see Chromosomes.
  climate and microclimate, treatise, 413.
  containers, soil temperature of, effect of structure and moisture, 323.
  diseases—see also Fungi and different host plants.
    development, factors in, 442.
    in Andaman Islands, 344.
    in Australia, 345.
    in Barbados, 441.
    in Nigeria, 345.
    in Prussia, 535.
    in Queensland, 441.
    new, 345.
    of ornamental plants, N.J. 852.
    tropical, control, 644.
    virus, studies, 645.
  growth—
    and development, effect of length of day, 120, 623.
    effect of decomposing paper, Mass. 318.
    effect of exchangeable ions in soil colloids, 813.
    effect of soil density, N.J. 831.
    internode, 623.
    laws, relation to crop production, 526.
    manganese requirement, 119.
    necessity for copper in, 516.
    neglected soil factors in, 816.
    of roots and tops, effect of length of day, 215.
    on acid soils, factors affecting, 209.
    temperature requirement, 414.
    toxic action of aluminum, 516.
  inspection, *see* Nursery inspection.
  integuments, permeability for ions, 213.
  introduction, foreign, correlating with experiment station projects, 889.
  juices, nitrates in, R.I. 512.
  materials, nitrogen in, effect of storage, Ind. 108.
  nutrients, chief, function, N.C. 118.
  nutrition, studies, Calif. 708.
  pathology in Germany, 441.
  pigmentation, *see* Anthocyanins *and* Pigments.
  pollination, *see* Pollination.
  Protection, Soviet Institute for, establishment, 600.
  respiration, *see* Respiration.
  solutions and leaf tissue, moisture fluctuations in, 214.
  symptoms, diagnostic value for soil deficiencies, 822.
  tissue and protein, analogy, 218.
  tissues, furfural penetration in, 519.
  viruses, aphid transmission, 247, 858.
  viruses, attenuation of, studies, 645.

Plantain—
  fruit rot and wilt, notes, 344.
  vitamin B complex in, 397.
Plants—*see also* Flora.
  absorption of nutrients at different growth stages, 322.
  absorption of potassium by, Ark. 721.
  browse, in western United States, U.S.D.A. 817.
  disease-resistant, cytological phenomena, 234.
  drought resistance of, physiological nature, 120.
  effect of radioactivity, 119.
  environmental complexes as dynamic systems, treatise, 212.
  fish poisoning and insecticidal, U.S.D.A. 846.
  hardiness, index to, Wis. 422.
  honey-producing, of State, N.C. 153.
  imported, U.S.D.A. 324, 623.
  longevity in, 517.
  mosaic-diseased, scolecosomes and similar bodies in, 443.
  ornamental—
    as honey plants, Iowa 153.
    cooperative cultural and varietal tests, N.Mex. 227.
    importation into Canada, condition, 542.
  perennial hardy, for landscape planting, Mich. 642.
  perennial, variety tests, N.C. 136.
  permeability, *see* Permeability.
  poisonous—*see also* Livestock poisoning *and specific animals and plants.*
    in Wyoming, Wyo. 176.
    to livestock, Ind. 70; Nev. 772.
    to livestock in Australia, review, 568.
  polymitotic, studies, N.Y.Cornell 216.
  relation to cations fully saturating soil exchange capacity, 812.
  rest period, shortening, 24.
  rôle of the rarer elements in, 628.
  tropical cultivated, diseases and pests, 644.
  water relations, 24.
  woody, *see* Woody plants.
Plasmodiophora—
  brassicae, see Cabbage clubroot.
  vascularum, life history, 349.
Plastids, nature and functions, 119.
Platyedra gossypiella—
  in Punjab, 655.
  notes, 246.
Platymetopius magdalensis, transmission experiments of cranberry false blossom, 358.
Plectodiscella veneta (?), notes, 644.
Pleospora herbarum on aster seed, N.Y.State 741.
Plesiocoris rugicollis—
  control, 54.
  on currants, control, 653, 654.
Pleuropneumonia—
  contagious, in cattle, 568.
  of cattle, detection, 567.
Plowing, fall v. spring, Utah 222.
Plows, coverage test in corn borer control, Ind. 182.
Plowshares treatment with a steel alloy or high speed steel, tests, Mich. 778.
Plum—
  aphid, mealy, life history and control Calif. 753.
  bacteriosis, notes, 644.
  curculio control by burying peach drops, 453.
  curculio in apples, control, Mass. 354.
  curculio larvae in peach drops, effect of sun, 851.
  Marianna, as root stock for peach, Tenn. 840.
Plums—
  fruit thinning, residual effects, Mich. 639.
  pollination experiments, 636.
  pollination requirements, 41.
  President, pollination, 41.
  spray schedule for, N.J. 42.
  varieties, Nebr. 829.
Plutella maculipennis, see Diamond-back moth.
Poa bulbosa, taxonomic study, 633.
Podosphaera leucotricha, notes, 345.
Poinsettia, *Diplodia* spp. affecting, Fla. 439.
Poisonous plants, *see* Livestock poisoning, Plants, poisonous, *and specific animals and plants.*
Pokeweed berries, ripe, effect on chickens, 574.
Polarimeter, half-shadow, illumination, 713.
Poles and logs, use in farm construction, U.S.D.A. 479.
Pollination—*see also specific plants.*
  problem of fruits in South Africa, 40.
Polycyrtus, new species, descriptions, 552.
Polyembryony, relation to delayed implantation in mammals, 218.
Polymitotic, a recessive Mendelian factor in corn, N.Y.Cornell 216.
Polyplax serrata, hatching of eggs, 244.
Pomace flies, X-ray experiments, 425.
Popillia japonica, see Japanese beetle.
Poplar, Carolina, as prevention for shifting sand, Mich. 742.
Population—
  flow, relation to rural and urban economic inequality, 285.
  increase, outlook for, 686.
  of Iowa, composition and changes, Iowa, 87.
  trends, relation to land utilization, 79.
Porcellio scaber, host of nematodes, U.S.D.A. 181.
Poria hypolateritia on tea plant, treatment, 241.
Poria spp., notes, 537.

Pork—
quality and palatability, factors affecting, Nebr. 860.
quality, effect of soybean products, *Ill.* 367.
quantity and quality, effect of growth and fattening processes, Ind. 64.
soft, hardening, Ga. 162.
soft, studies, 555; N.C. 165.
Porthetria dispar, *see* Gipsy moth.
Potash—
as top-dressing for wheat, effect, Ga. 123.
carriers for crops, comparison, R.I. 526.
effect on citrus fruits, Fla. 434.
effect on potatoes, Fla. 434.
fertilizers, effect on mealiness of potatoes, 91.
sources in mixed fertilizers, effect on cotton yield, 631.
Potassium—
absorption by plants, Ark. 721.
carriers for sweet potatoes, N.C. 126.
deficiency, effect on fruit trees, 638.
effect on chloroplast pigments, 25.
effect on wheat leaf rust susceptibility, Ind. 143.
fertilizers for tobacco, Conn.State 334.
nutrition of peas, effect of length of day, Mich. 722.
oleate and nicotine, insecticidal value, 50.
requirements of drained marshlands, Wis. 421.
rôle in growth and development of plants, Ind. 112.
sources, comparison, Miss. 126.
sulfate, effect on flax, 529.
Potato—
aphid—
life history, habits, and control, Va.Truck 156.
notes, 248.
transmission of plant viruses by, 853.
Association of America, proceedings, 826.
bacterial diseases, 347.
bacterial wilt, notes, Fla. 439.
beetle, Colorado, lethal dose of acid lead arsenate, 855.
black scab in Belgium, 45.
blackleg—
induced by maggots, Me. 748.
rôle of seed-corn maggot in, 360.
studies, 347.
blight—
late, in Canada, 647.
late, notes, 347; Fla. 439.
notes, 845.
outbreaks, relation to weather, 809.
breeding, papers on, 827.
curly dwarf, unmottled, infection experiments, Nebr. 448.
disease, new and destructive in Utah, 238.
Potato—Continued.
disease, obscure, in England, 647.
diseases—
degeneration, insect transmission, Nebr. 837.
fungus, 347.
in Prussia, 535.
papers on, 826.
virus, hosts and carriers, 347.
virus, properties and behavior, 238.
virus, rôle of insects in, 652.
virus, studies, Calif. 744.
flea beetle on tobacco, Conn.State 356.
Fusarium wilt, varietal susceptibility, 843.
glassy end, studies, 647.
Growers Exchange of Colorado, 585.
leaf roll, relation to insects, 757.
leafhopper and its close relatives, distribution, 455.
leafhopper on legumes, injury, 44.
maggot, effect on potato seed pieces, Me. 749.
net necrosis v. stem-end browning, Me. 749.
rugose mosaic, properties and behavior, 238.
scab, control, Mich. 746; N.J. 837.
scab, notes, 345.
scab, studies, Vt. 539.
scurf, control, Mich. 746.
spindle tuber—
infection experiments, Nebr. 348.
transmission, Fla. 439.
transmission by grasshoppers, 238.
sprouts for production of red scale for insectary, Calif. 756.
stalk borer, notes, Mich. 153.
stem-end rot, varietal susceptibility, 843.
tip and margin burn, relation to insects, 238.
tuber worm in Uruguay, biology, 655.
tubers, host anatomy and blight susceptibility, correlation, 446.
virus, combining with tomato mosaic virus, Ind. 144.
warehouse ventilation, Mich. 778.
wart in Belgium, 45.
Potatoes—
American varieties, origin, 827.
analyses, Conn.State 789.
breeding, N.C. 126; Nebr. 822.
cooking quality, effect of storage temperatures, 891.
culinary quality, predetermining, U.S.D.A. 508.
cultivation experiments, 828; N.Y.Cornell 635.
culture experiments, Fla. 429.
early, car-lot shipments from Florida and competing areas, Fla. 886.
early, marketing, U.S.D.A. 85.
early, production in Virginia, farm business survey, Va. 483.
effect of preceding crop, R.I. 527.
effect of windbreaks, Wyo. 127.

Potatoes—Continued.
fertilizer experiments, Ala. 428; Conn. Storrs 726; Fla. 429; Miss. 31; N.C. 126; Wyo. 127.
hill spacing tests, Mich. 633.
irrigation experiments, N.Mex. 221, 272.
late, fertilizer experiments, Mich. 719.
mealiness in, relation to potash fertilization, 91.
planting tests, Mich. 729.
price in Great Britain, 387.
production practices, Alaska, 732.
quality, effect of early planting, Mich. 433.
seed—
disease-free stocks, testing, Mich. 745.
dry land v. irrigated, Wyo. 127.
factors affecting vigor, Conn.Storrs 726.
greening before planting, Ohio 433.
northern and native-grown, W.Va. 633.
northern-grown, value, R.I. 527.
of good quality, scarcity, Mich. 496.
papers on, 826.
treatment, Mich. 729; Nebr. 822.
treatment, effect on yield, Me. 749.
tubers, effect of green sprouting, 827.
seed-piece decay and blackleg induced by maggots, Me. 748.
selection, Miss. 31.
shipments, Fla. 481.
spacing experiments, Ala. 428.
spraying, Mich. 729.
spraying and dusting experiments, Fla. 149; N.Y.State 332.
Triumph, dormancy, effect of maturity and chemical treatment, Nebr. 827.
tuber index work, Wis. 441.
varieties, identification by chemical tests, 529.
variety tests, Ala. 428; N.J. 824; Utah 222; Wyo. 127.
Potentiometer, electron tube, modification, 206.
Poultry—*see also* Chickens, Ducks, Fowls, *etc.*
and cotton farming, returns from, Ala. 480.
and poultry products, statistics, U.S.D.A. 486.
as source of income for farm women, Nebr. 887.
breeding for egg production, Iowa, 168; Mass. 368.
cold storage holdings, U.S.D.A. 784.
diseases—*see also specific diseases.*
Colo. 72; Iowa 179.
identified by autopsies, N.J. 473.
list, Calif. 771.
septicemic, studies, N.C. 179.
Poultry—Continued.
effect of cod-liver meal feeding, N.H. 64.
experiments, Nebr. 862.
external parasites, treatment with orthophenylphenol, Mich. 772.
feed, coefficients of digestibility, calculating, 556.
feeding and breeding experiments, Can. 60.
feeding, effect of free choice of feed, 557.
feeding experiments, Ind. 167; Md. 861; N.Mex. 256; S.C. 556; Wyo. 168.
flock, culling, 64.
hen-feathered Brown Leghorns, production, 122.
house, Illinois shed-roof, construction, Ill. 479.
house, rammed earth, studies, Calif. 777.
houses—
and equipment for Montana, 881.
ventilation, Calif. 764.
ventilation and construction studies, Nebr. 878.
housing, studies, Ind. 183.
husbandry, nomographic methods in, 256.
inbreeding problem, 254.
industry in New Zealand, 584.
industry, statistics and charts, U.S.D.A. 84.
lice, new, in Bahama Islands, description, 548.
linkage groups in, 328.
management and cost of production, N.Mex. 256.
multiple unit laying house, plans and materials, N.J. 578.
nutrition studies, N.J. 863.
nutritive requirements, 257.
parasites, internal, in Quebec, 271.
parasites, use of nicotine against, 675.
pathological diagnosis, N.J. 874.
production and costs, Ala. 480.
production, ultra-violet light in, 560.
protection from cold, Wyo. 168.
raising, houseless method, 560.
raising, treatise, 64.
rations, wheat in, 659.
sanitation, principles and practices, Ill. 765.
studies, Wis. 462.
tobacco feeding for parasites, effect of concentrations of nicotine, 382.
Powder post beetles, notes, 852.
Power plants for farms, U.S.D.A. 74.
Power resources of McKenzie River and tributaries, 575.
Pox, avian and mammalian, studies, 567.
Prairie chickens of Wisconsin, studies, 248.
Precipitation—*see also* Rainfall, Snowfall, *etc.*
and run-off on Wasatch Plateau in Utah, U.S.D.A. 477.

Precipitation—Continued.
and sun spots, correlation, 714.
in valleys and on adjoining mountains in Utah, U.S.D.A. 616.
Pregnancy—
basal metabolism during, 395.
early, diagnosis, 428.
maintenance, relation to ovaries, 427.
relation to corpora lutea extracts, 219.
Preisz-Nocard bacillus infection, resistance, 570.
Prenolepis bourbonica in Florida, 58.
Price stabilization under Federal Farm Board, 279.
Prices, index numbers, Ohio 481, 678.
Pricklypear, *see* Cactus.
Pristomerus ocellatus, notes, N.J. 54.
Probability, theory of, 520.
Prolamins of milo and feterita, 10.
Propionic acid bacteria, formation and identification of acids, 711.
Protein—
concentrates, evaluation, Ind. 158.
concentrates v. tankage for pigs, Ind. 162.
deficient rations, effect on breeding pigs, 68.
feeds, commercial mixed, as supplement to farm grains for swine, 255.
requirements of chicks, 257.
requirements of pullets, Ind. 167.
solutions, alkali, viscosity, 802.
supplements, commercial mixed, for pigs, comparison, Mich. 763.
supplements for fattening steers, Iowa 159.
supplements for pigs, comparison, N.C. 165.
Proteins—
and plant tissue, analogy, 213.
biological values, 586.
cereal, effect of heat on biological value, 789.
characterization by affinity determinations, 802.
coagulation in presence of acetates, effect of alcohols, 710.
combination with iron, mode of, 10.
dielectric constant, studies, 608.
digestibility, determination, 663.
in blood, effect of vitamin B deficiency, 95.
in diet, effect of different per cents, 790.
serum, chemical individuality, 803.
serum, effect of lecithin on stability, 803.
sources, effect on cost of egg production, N.C. 168.
utilization by growing chicks, Nebr. 862.
Protostrongylus rufescens, life history, 548.
Protozoa, rôle in activated sludge, 419.
Provitamin A, properties, 803.
Prune—
die-back, control, Calif. 736.
peroxidase, inactivation, temperature, effect of pH, 214.
Prunes, canned, swelling, Calif. 110.
Pruning—*see also specific crops.*
study of water movement in relation to, Oreg. 738.
Pseudococcus—
citri, *see* Mealybug, citrus.
comstocki in Connecticut, Conn.State 451.
gahani on pears and apples, control, Calif. 753.
gahani, parasites of, Calif. 755.
spp., biological control, Calif. 156.
Pseudomonas—
campestris, notes, 345.
cerasus, production of agglutinins by, 840.
citri, *see* Citrus canker.
citriputeale, notes, 345.
fluorescense, notes, 360.
hyacinthi, notes, 542.
malvacearum in cotton plant, development, 646.
malvacearum, notes, 345.
non-liquefaciens, notes, 360.
radicicola, *see* Nodule bacteria.
tumefaciens, longevity in soils, 234.
tumefaciens, strains, prevalence in soils, 234.
tumefaciens, weed host of, 43.
Pseudoperonospora humuli zoospores, action of chemicals on, 539.
Pseudopeziza medicaginis, notes, 345.
Pseudopityophthorus, revisional study of genus, 551.
Psila rosae, *see* Carrot rust fly.
Psilochasmus oxyurus, notes, 353.
Psittacosis, studies, 471.
Psorosis on tangerine trees, Fla. 438.
Psychotria carthaginensis, notes, 657.
Public finance, relation to agriculture, research in, 388.
Puccinia—
antirrhini, studies, 543.
coronata epidemics, eradication of hosts, 49.
coronata, studies, Calif. 744.
dispersa, microscopic study, difficulty in, Calif. 744.
glumarum in Alberta, 537.
graminis tritici, notes, 345.
graminis tritici, physiologic forms, variation, 236.
iridis, notes, 542.
sorghi in corn, inheritance of resistance to, 45.
triticina—*see also host plants.*
form XI, nuclear phenomena in, 444.
Puerperal hemoglobinemia of bovines, 775.
Pullets—*see also* Chickens *and* Poultry.
protein requirements, 257; Ind. 167.

Pullorum disease—*see also Salmonella pullorum.*
agglutination and intradermal tests, comparison, 73.
agglutination test, intermittent reactor, N.C. 180.
antigen, production, Ind. 174.
bacteriology and pathology, 382.
carriers, identification, simplified method, 574.
control, 567, 870; Mass. 375.
control, short interval testing, N.C. 180.
detection, Ohio 475.
eradication, Mass. 776.
septicemic, in adult fowls, 382.
studies, 271; Wis. 470.
whole blood test for, Calif. 771.
Pulpwood lands in Northeast, reproduction on, U.S.D.A. 141.
Pulses in Java, agromyzid flies of, 656.
Pupipara of China, 546.
Purdue University, notes, 798.
Purnell Act, first five years of, 889.
Purslane, water requirements, 128.
Pustule scale, control, V.I. 737.
Pyocyanine, potentiometric study, 202.
Pyrausta nubilalis, see Corn borer, European.
Pyrethrum—
as insecticide and cultivation in England, 547.
culture, Tenn. 830.
kerosene extracts, 851.
larvicide for mosquitoes, N.J. 847.
mosquito larvicide, application, 656.
products, toxicity, effect of soap on, 51.
sprays v. nicotine sulfate sprays for bean jassid, Fla. 451.
white oil, spraying tests, 55.
Pyridine- and quinoline-carboxylic acids, condensation with amino acids, 710.
Pyridylpiperidines, isomeric, and neonicotine, 547.
Pythiacystis citrophthora, treatment, 351.
Pythium aphanidermatum on Opuntia, 240.
Quack grass—
control, Iowa 125; N.Dak. 39.
control in potato fields, Mich. 496.
treatment with chlorates, optimum time, 635.
Quail—
bobwhite, habits, preservation, and increase, treatise, 544.
Eimeria spp. affecting, 876.
of California, 352.
studies, Wis. 449.
Quince—
fire blight, control, Tenn. 840.
fire blight resistant varieties, 351.
overgrowths and hairy root on nursery stock, 48.
rust on apples resistant to cedar rust, Tenn. 840.
Quinces, pollination requirements, 41.
Quinine—
action on *Bacillus abortus,* 869.
action on bovine uterus, 869.
Quinoline- and pyridine-carboxylic acids, condensation with amino acids, 710.
Rabbit—
embryo, growth, effect of breed, 725.
liver, glycogen extraction from, 202.
ova, living, studies, 28.
Rabbits—
experimental coccidiosis of, 73.
for food and fur, treatise, 663.
infected with fixed rabies virus, specific antibodies in serum, 568.
snowshoe, *Bacterium tularense* in, 267.
Rabies in dogs, immunization, 674.
Radiators, direct steam, heating efficiency, 297.
Radio waves, effect on insects and plants, differential between, 454.
Radio waves, effect on insects in stored products, 652.
Radioactivity, effect on plants, 119.
Radiosensitivity of *Vicia faba,* 26.
Radishes, production under Vitaglass, Mass. 339.
Raffinose, enzymic synthesis, 310.
Ragweed, great, chemical composition at various stages, 629.
Ragwort control by spraying, 533.
Rahar wilt, notes, 441.
Rainfall—*see also* Precipitation.
and frost data, Utah 299.
British, long-range predictions, 509.
effect on barley yield, 223.
effect on corn yields in Kansas, 510.
effect on strawberries, Ala. 434.
in Ohio, 1930, and corn and hay yields, Ohio 481.
Ramularia areola, notes, 646.
Ranches, types and operating practices, Mont. 583.
Range—
cattle, digestibility of cottonseed meal for, N.Mex. 255.
cattle production, natural conditions, S.Dak. 187.
grasses, studies, N.Mex. 221.
land investigations, Can. 825.
livestock producer, problems, 253.
nutrition in California, 254.
plants, poisonous, *see* Plants, poisonous, *and specific plants.*
utilization research in northern Great Plains, 253.
Ranges of New Mexico, artificial reseeding, N.Mex. 32.
Rape pasture v. alfalfa for pigs, Mich. 164.
Raspberries—
black—
elongation of canes, factors affecting, 231.
propagation, value of selection in, Mich. 639.
studies, Mich. 140.
virus diseases, N.Y.State 447.

Raspberries—Continued.
breeding, Tenn. 830.
effect of irrigation, Oreg. 740.
fertilizer experiments, R.I. 534.
fruiting habit, Colo. 139.
native, qualities, Hawaii 737.
varieties imported for breeding and culture, Hawaii 737.
variety tests, Mass. 340; N.J. 833; Tenn. 830.
Raspberry—
blue stripe wilt, notes, 644.
cane spot, notes, 644.
crown borer, ovicides for, N.J. 832.
crown gall studies, Wis. 440.
fruit worm, notes, Mich. 153.
horntail, studies, Calif. 53.
mosaic, notes, 644.
root borer, ovicides for, N.J. 832.
root borer, studies, Calif. 53.
spur blight, notes, 644.
stock, certified, and inspection, 834.
weevil in Sweden, 552.
Rat flea survey of San Juan, Porto Rico, report, 361.
Rats—*see also* Rodents.
feeding experiments, equipment for, 897.
growth, food requirements, 690.
scaly tail condition, relation to fat-free diet, 895.
segmentation of tail, 794.
vegetarian, growth on omnivorous diet, 692.
Reclamation policies in Pacific States, 580.
Recreation as land use, Wis. 481.
Red Arrow, toxicity, effect of soap on, 51.
Red mite—
control, N.J. 848.
on apple, control, 757.
Red scale problem, 549.
Red spider—
control with naphthalene, Mass. 344.
studies, Calif. 53.
Redtop, fertilizer experiments, Conn.Storrs 727.
Reducase in vegetables, factors affecting, N.J. 830.
Redwood—
lumbering operations, Calif. 742.
strength, effect of extractives, 779.
Reed canary grass as forage crop, tests, 638.
Reed grass as forage crop, N.C. 158.
Refractometer, use in sugarcane seedling work, 36.
Refrigeration, dairy, studies, N.C. 173.
Refrigeration, mechanical, value on dairy farm, Ind. 172.
Relapsing fever—
in central Texas, 266.
transmission by ticks, 657.
Remigia frugalis, notes, 56.
Reproduction—
accessory glands in male guinea pig, physiology, 122.
relation to diet, 395.
Research—*see also* Agricultural research.
and reports, manual on, 479.
from farm viewpoint, aims of, 581.
harmonizing teaching with, 255.
in local and national outlook work, 276.
methods in England, 482.
program, organization, 889.
scientific, methods and status, treatise, 487.
State, relation to readjustment of agriculture, 888.
work, cooperation of home economics divisions with commercial organizations, 889.
Reservoir sites for flood control, field examinations of, 272.
Resins, synthetic, preparation from alkali lignin, 409.
Respiration—
chamber for small animals, modification, 98.
of tomato fruits, 215.
Reticulitermes flavipes, notes, Ohio, 852.
Retiring day, paper on, 889.
Rhabdopterus picipes as apple pest, 58.
Rhagoletis—
cingulata, *see* Cherry fruit fly.
fausta, notes, 57.
pomonella, *see* Apple maggot *and* Blueberry maggot.
suavis completa, notes, Calif. 755.
suavis, notes, 57.
Rhamnus species susceptible to crown rust, eradication, 49.
Rhipicephalus—
bursa, transmission of *Anaplasma marginale* by, 553.
sanguineus—
and virus of boutonneuse fever in Tunis, transmission, 871.
cause of inapparent infection in man, 871.
latent parasitism of *Ixodiphagus caucurtei* in, 59.
transmission of kala azar by, 553.
Rhizobia, effect of passage through host plant, Wis. 422.
Rhizobium—
leguminosarum, studies, Iowa 113.
spp., changes produced in nitrogenous compounds by, 418.
spp. passage through host, effectiveness, Wis. 443.
trifolii on red clover, nitrogen fixation by, Wis. 422.
Rhizoctonia—
bataticola, notes, 646.
crocorum and *Helicobasidium purpureum*, identity, 444.
solani, notes, 441, 646.
tuliparum, notes, 542.
Rhizoctonia—
new, isolated from diseased coffee trees, 649.
on potatoes, effect of seed treatment, Me. 749.

Rhizopus artocarpi, notes, 344.
Rhode Island Station, notes, 499, 700.
Rhode Island Station, report, 598.
Rhododendron—
die-back, notes, N.J. 839.
lace bug, sprays for, 50.
Rhopalosiphoninus tulipella, notes, 247.
Rhopalosiphum pseudobrassicae, *see* Turnip aphid.
Rhubarb—
breeding, Tenn. 830.
variety tests, Tenn. 830.
wilt, notes, 644.
Rhynchocoris humeralis, life history, 547.
Ribes—*see also* Currants.
eradication by chemicals, U.S.D.A. 448.
Rice—
culture experiments, Ark. 732.
farming in Arkansas, Ark. 280.
fertilizer experiments, Ark. 732.
glutelins, optical rotation, 108.
harvesting methods, Calif. 777.
in deep bin, resistance to passage of air through, 578.
in Pacific regions, 628.
industry of Calauan, Laguna, irrigation practices in, 879.
inheritance of characters in, 522.
insect, destructive, in China, life history, 657.
insects of Lanchi district of China, 652.
irrigation, duty of water and cost of pumping, Ark. 575.
pest in Malaya, 247.
pests, papers on, 756.
polished, toxin in, 894.
polishings, vitamin B_1 in, curative activity, 593.
polishings, vitamin G in, Ill. 589.
premature heading in, 530.
sclerotial disease, notes, 344.
soils, irrigated, changes in phosphorus availability, 212.
stem borers and parasites in Japan, 756.
stem rot, studies, 644.
varieties for California, Calif. 728.
vitamin G in, 93.
Rickets—
among Indian school children, 398.
effect of elementary phosphorus, 695.
experimental, in rats, 97, 870.
in chicks, effect of S-1 lamp irradiation, 559.
in rats, calcium in striated muscles, 553.
indirect ray therapy, papers on, 567.
light therapy in, evaluation, 193.
low phosphorus, mechanism of healing, 893.
prevention, value of Colorado sunshine in, 96.
ultra-violet irradiation for, minimal amount, 296.
value of California summer sunshine in treatment and prophylaxis, 695.
Rinderpest—
immunization of cattle, serum-simultaneous method, 670.
in India, 571.
River stages, daily, at gage stations, U.S.D.A. 74.
Roads—
concrete, *see* Concrete.
county, of North Carolina, and finance survey, U.S.D.A. 74.
earth, oil-treated, in Missouri, U.S.D.A. 575.
toll, history and status, U.S.D.A. 478.
Rock phosphate, *see* Phosphate.
Rocky Mountain spotted fever—
and typhus group, 59.
papers on, 546.
type of infection, identification, 59.
Rodent pests, notes, Ind. 153.
Rodents—*see also* Mice *and* Rats.
control with thallium, U.S.D.A. 151.
injurious, information for field men controlling, U.S.D.A. 242.
native, male genital apparatus, 217.
Roentgen rays, *see* X-rays.
Rogas granulata n.sp., description, 59.
Roof, tile, waterproofing, Iowa 183.
Root—
bacterioids, reproduction, Wis. 422.
crops, variety tests, Mich. 729.
knot nematode, biological studies, Calif. 754.
knot nematode, development in root tissues, Hawaii.Pineapple Canners' 844.
nodules, *see* Nodule bacteria.
tips, sensitive to gravitational stimulus, 423.
Roots—
and tops of plants, development, effect of length of day, 215.
growth and stimulational movement in, 723.
neoformations in, effect of rare earths, 26.
Rose—
beetle, Fuller's, studies, Calif. 53.
black spot, notes, N.J. 839.
brown canker, development, 352.
canker, notes, N.J. 839.
diseases, 352.
seedlings for Tennessee conditions, Tenn. 840.
stem girdler, notes, Conn.State 451.
Rosellinia bunodes, notes, 649.
Roses—
carbon dioxide storage, 412.
Diplodia spp. affecting, Fla. 439.
variety tests, Miss. 39; N.C. 136.
Rosettes, distribution on chorion of pigs, 218.
Rosinduline as oxidation-reduction indicator, 204
Rotation of crops, Can. 825; Miss. 31, 126; N.C. 115, 126; Nebr. 822; Utah 222; Wyo. 127.
and manuring experiments, Utah 827.

Rotation of crops—Continued.
effects of clover and alfalfa, Colo. 717.
Rotenone—
and nicotine, relative toxicity to *Aphis rumicis* and mosquito larvae, 846.
containing preparations, insecticidal value, 51.
in solution and suspension, change in toxicity, 52.
in solution, decomposition, 246.
toxicity to goldfish, 547.
Roughages—
carbonaceous, comparison, N.C. 159.
for fattening steers, Iowa 159.
grinding, value, 677.
processing for dairy cows, Ohio 467.
Roundworm ova, development and survival, Minn. 151.
Roup—
complex and fowl paralysis, 270.
immunization, Mich. 176.
use of bacterin for, Mich. 772.
Royal Grain Inquiry Commission, report, 385.
Rubber—
blackroot fungi affecting, 649.
diseases, notes, 344.
seed oil, characteristics, 410.
Rumex crispus, weed host of *Pseudomonas tumefaciens*, 43.
Run-off relation to plant cover on Wasatch Plateau in Utah, U.S.D.A. 477.
Rural—*see also* Community.
community, area and structure, 686.
credit, *see* Agricultural credit.
economics, manual, 578.
government, field for study, 686.
home equipment, evaluating, 390.
labor, *see* Agricultural labor.
life, philosophy of, 686.
life, socializing influences of organizations in, Mich. 784.
organization, looking ahead in, 686.
organizations and farm families, 686.
organizations for young people, Va. 391.
population, characteristics, correlations between, Conn.Storrs 781.
population, movement, 79.
population, movement, economic and social aspects, Okla. 285.
sociology, papers on, 686.
sociology, systematic source book, 687.
standards of living, *see* Standards.
towns of Connecticut, indexes of urbanization, 391.
Rust fungi, heterothallism in, 536.
Rusts—*see also specific hosts.*
evolutionary tendencies and origin of life cycles, 444.
sexuality and origin of life cycles in, 444.
Rutabagas, *see* Swede.
Rutgers University, notes, 498.
Rye—
Agreement, German-Polish, 682.
Rye—Continued.
and vetch combinations for grain hay, Idaho 222.
and wheat hybrids and back crosses, genetics, 326.
fertilizer experiments, Fla. 429.
for fattening lambs, Nebr. 660.
glutelins, optical rotation, 108.
improvement, N.J. 824.
powdery mildew resistant varieties, Ind. 144.
rust resistance, studies, Ind. 143.
selfed, fertility of parent and progeny, Ga. 123.
Ryegrass, perennial, inheritance in, 121.
Saccharomycete pleomorphus virulens, pathogenic for man and animals, 872.
Saccharum, cytology, 531.
Saddled prominent, outbreak, Conn.State 451.
Safflower, seeding experiments, Wyo. 127.
Sage honey, acetic acid in, 408.
Sahlbergella spp. on cacao in Gold Coast, 246.
St. Lawrence navigation and power project, rejoinder, 285.
Saissetia oleae, see Black scale.
Salmon—
oil, comparison with cod-liver oil as to vitamin content, 397.
poisoning, studies, 72.
Salmonella—
agglutination and related phenomena, 377.
organism causing epidemic abortion in sheep, 377.
Salmonella—
enteritidis, notes, 675.
pullorum—*see also* Pullorum disease.
detecting, Mich. 176.
in eggs from reactor hens, 382.
isolation, medium for, Mich. 772.
utilization of citric acid as source of carbon, R.I. 572.
virulent strain, Mass. 375.
Salt—
added to moistened alfalfa hay, effect on bacterial growth, 629.
applications to sugar beets, effect, Mich. 729.
estimation in mixed feeds, Tex. 615.
for curing meat, quantity, N.C. 165.
Salvastrum dolichanthum n.sp., description, Tex. 817.
San Jose scale—
control with oil sprays, N.Mex. 245.
tests with paradichlorobenzene-oil emulsion, 50.
Sand—
culture apparatus, large, 208.
flies of Italian foci of visceral leishmaniasis, 861.
Sands, shifting, prevention, Mich. 742.
Sandy soils—
growth of pine in, 288.
liming, effect, Fla. 415.
magnesia deficiencies, N.C. 114.

Sanitation, importance in prevention and control of bovine tuberculosis, 267.
Sanninoidea exitiosa, *see* Peach borer.
Santonin as anthelmintic for swine, 572.
Saperda candida, *see* Apple tree borer, round-headed.
Sarcosporidia, hemotoxin in, 772.
Sardine—
  meal, feeding value, Calif. 764.
  oil, comparison with cod-liver oil as to vitamin content, 397.
Satin moth—
  parasite, biology and habits, 758.
  spread, Conn.State 451.
Sauerkraut, manufacture, N.Y.State 807.
Sawflies of subfamily Dolerinae, 657.
Scabby mouth in sheep and goats, 71.
Scales visited by ants, control, 60.
Scapanes australis on coconut palms, 58.
Scarabanema cylindricum n.g. and n.sp., description, 361.
Schistocerca gregaria, biology and control, 359.
School—
  courses in home relations, objectives, 90.
  financing in Michigan, Mich. 82.
  vocational, *see* Vocational education.
Sciara nitidicollis, structure and life history, 250.
Scirpophaga auriflua, injury to sugarcane, 355.
Sclerophoma magnusiana n.sp., description, 751.
Sclerotinia—
  americana, proposed name, 540.
  bulborum, notes, 542.
  cinerea, notes, 540.
  fructigena, notes, 540.
  sclerotiorum spores, overwintering, Calif. 744.
Sclerotium—
  gladioli, notes, 542; Mich. 745.
  oryzae, notes, 344.
  rolfsii, notes, 542; Ga. 142.
  tuliparum, notes, 542.
Scolecosomes and similar bodies in mosaic-diseased plants, 443.
Scolia—
  formosa, notes, 59.
  manilae, notes, 497.
Scolytus destructor, nematode infesting, 551.
Scolytus quadrispinosus infestation, relation to lowered tree vitality, 454.
Scolytus rugulosus, *see* Shot-hole borer.
Scouring rush, poisonous to livestock, Ind. 70.
Scrotum of swine, characteristic hemangiomata in, 568.
Seal, fur, of California islands, 352.
Secotium acuminatum, sterol production and antirachitic activatibility, 398.
Seed—
  caterpillar on clover in Oregon, 758.
  collecting for Norway pine, new principle, 843.
Seed—Continued.
  disinfectants for corn, relative efficiency, 235.
  disinfectants for hull-less barley, 235.
  disinfectants for oat smut, Mich. 149.
  testing station for England and Wales, 533.
  testing station in New Zealand, 533.
  weevils, morphology and biology, 551.
Seed-corn maggot—
  and bacteria, relation, 360.
  effect on potato seed pieces, Me. 748.
  on tobacco, Conn.State 356.
  on young tomato plants, Tenn. 851.
  rôle in spread and development of potato blackleg, 360.
Seedlings, growth in light and in darkness, relation to food reserve, 517.
Seeds—
  analysis, 532; Vt. 532.
  autolysis in, 423.
  carbohydrate storage in, Iowa 119.
  certification work, Tenn. 825.
  germination—
    effect of disinfectants, 44.
    effect of long-continued soaking, 423.
    influencing, 24.
    studies, 24.
  hard, problem, 39.
  imported, U.S.D.A. 623.
  inspection, Ind. 38; Mass. 38; Me. 133; N.J. 39.
  oil, *see* Oil seeds.
  of garden plants, insects affecting, 246.
  salt, State laws, N.J. 634.
  stimulation, 119.
Self-feeder—
  for hogs, Wis. 64.
  value for fattening lambs, Minn. 62.
Semen, human, biochemical studies, 27.
Semesan Jr., fungicidal value, N.Y.State 148.
Septic sore throat of men, gargety cows as carriers, Wis. 470.
Septicemia, hemorrhagic, in East Prussia, 868.
Septicemic disease of fowls, N.J. 874.
Septoria—
  callistephi on aster seed, N.Y.State 741.
  gladioli, notes, 542.
  sp., notes, 646.
Sesamia nonagrioides in France, 249.
Sesamum indicum—
  biology and types, 530.
  malformation and proliferation, 441.
Seurocyrnea colini, developmental stages, U.S.D.A. 181.
Sewage—
  disposal—
    and water supplies, N.J. 879.
    for North Dakota farm homes, 881.
    plants, control of mosquitoes breeding in, N.J. 847.
    studies, N.J. 781.

Sewage—Continued.
purification, activated sludge process, 419.
Sex—
and number of human offspring, relation, 526.
chromosomes in different breeds of sheep, 217.
determination in ground squirrel, 218.
glands of mammals, formation, 725.
hormone antagonism, 329.
hygiene and reproduction of cattle, treatise, 378.
in hemp, 424.
mechanism in Uromyces forms, 445.
physiological basis, 525.
ratio in cattle, Wis. 424.
ratio in pigs, factors affecting, 526.
ratios in rats, effect of lecithin, 426.
Sexual—
characteristics, secondary, development, 525.
cycle in birds, 726.
Sexuality—
intermediate stages, 626.
significance, 525.
Shark-liver oil, absorption curves of acids, 805.
Sheep—*see also* Ewes *and* Lambs.
breeding by artificial insemination, 27.
breeding experiments, Can. 60; Ohio 820.
breeds, sex chromosomes in, 217.
diseases—*see also specific diseases*, Calif. 771.
feeding experiments, Can. 60; Wis. 460; Wyo. 161.
forage plants for, Wyo. 160.
fringed tapeworm in, pathogenicity, 178.
Hampshire, studies, Wyo. 762.
heat production, N. H. 857.
improvement, Missouri plan, 554.
inbreeding, 254.
management in Oklahoma, 554.
Merino, wool variations, 62.
native, upgrading, N.C. 160.
oestrous cycle in, 254.
poisoning—*see also* Plants, poisonous, *and specific plants*.
by *Corydalis caseana*, 177.
by death camas, Wyo. 177.
by fitweed, Nev. 668.
by laurel, U.S.D.A. 177.
by seeds of burrawang, 571.
production in California, 660.
range, and wool in Western States, treatise, 62.
research work in England, 482.
scabby mouth of, 71.
statistics, U.S.D.A. 486.
stomach worms, treatment, Mich. 175.
studies, Calif. 761; Nev. 761.
urinary calculi in, 254, 379.
Shelterbelts, planting and care, Wyo. 739.
Sherbets—
freezing, control of overrun in, 69.
honey in, 69.
quality, speed of dasher and scraper affecting, 667.
variations in local prices, Mo. 485.
Shot-hole borer, notes, Mich. 153.
Shrew, short-tailed, habits, 242.
Shrubs—
ornamental, as hosts of pear blight, Calif. 744.
studies, N.J. 835.
Siburlak of horses, 868.
Silage—
clover, feeding, effect on quality of butter, 372.
clover, feeding, effect on quality of Holland cheese, 372.
corn, for yearling draft foals, Wis. 462.
corn v. sorghum, effect on butterfat in milk, N.C. 170.
crops, comparison, Mich. 628.
feeding value for lambs, Idaho 255.
production, labor requirements, Conn. Storrs 781.
soybean, feeding value, Fla. 467.
Silica gel, density of water films adsorbed on, 504.
Silk fabrics, weighted and unweighted, breaking and bursting strength, Ohio 696.
Silkworm, wild, life history, 547.
Silos—
filling, labor requirements, Conn.Storrs 781.
filling methods and costs, Mo. 676.
trench, construction, Ala. 479.
trench, construction and use in humid regions, 254.
Silver sulfate and various dithio acids, reaction, 204.
Silverfish as household pest, U.S.D.A. 757.
Sires—*see also* Bulls.
dairy, selection and care, La. 66.
proved, value for herd improvement, 561.
Sitotroga cerealella, *see* Angoumois grain moth.
Sitrodrepa panicea, *see* Drug-store weevil.
Skim milk—
dry, for calves, 254.
dry, in ice cream, Mich. 769; N.Y. Cornell 173.
dry, in ice cream and cream cheese, N.Y.State 374.
dry, value for chicks, Ind. 167.
v. meat scrap as cottonseed meal supplements, S.C. 557.
Skin flora of white rats, Ala. 471.
Sky radiation—
in Baltimore, annual variation, 96.
in Colorado, annual variation, 97.
Smuttox, fungicidal value, Mich. 149; N.C. 146.
Snakeroot, white, poisonous to livestock, Ind. 70.

Snapdragon—
diseases, N.J. 352.
rust, studies, 543.
Snapdragons, soil reaction for, Mass. 339.
Snowfall, Rocky Mountain, relation to subsequent weather, 616.
Soap—
and arsenate of lead, effect on conifers, 50.
effect on toxicity of pyrethrum product, Red Arrow, 51.
Social—
changes, papers on, 687.
conflict and economic relationships, Mich. 486.
economic conditions of Porto Rico, 390.
Sociology, quantitative and cultural, studies, 686.
Sodium—
arsenate, use against termites in timber, 246.
chlorate for weed control, Iowa 125; Wis. 432.
chloride, *see* Salt.
fluosilicate, toxicity to farm animals, 358, 669.
fluosilicate v. borax in controlling house flies, 458.
nitrate, effect on apple trees, Ohio 833.
nitrate, effect on flax, 529.
nitrate fertilization studies, Iowa 113.
Soil—
acidity, nature, effect of silica-sesquioxide ratio, 210.
acidity studies, Mich. 717.
analysis, hydrometer method, temperature correction in, 208.
and water conservation, national program, 320.
bacteria, growth, effect of nonnitrogenous compounds, N.Y.State 21.
colloids, *see* Colloids.
composition, effect of green manure, Fla. 416.
conditions, relation to composition of crops, Calif. 708.
constants, subgrade, significance and application in practice, US.D.A. 779.
density, effect on plant growth, N.J. 831.
eroded, characteristics, 320.
erosion—
and run-off, Calif. 718.
and run-off, rôle of forest vegetation, 575.
control, extension program for, 320.
relation to grazing on Wasatch Plateau in Utah, U.S.D.A. 477.
studies, Utah 207.
fauna of sugarcane fields in Hawaii, 356.
fertility—
conference, Pennsylvania, editorial, 301.

Soil—Continued.
fertility—continued.
determination, comparison of methods, 506.
effect of crop rotation v. continuous cotton, Miss. 126.
studies, Ala. 415; Calif. 718; Ind. 112; Iowa 113; La. 718; Mass. 317; Mich. 718; N.C. 114; Nebr. 809; Nev. 720.
forming processes in Hawaiian Islands, 512.
management—
program for Carrington loam, Iowa 21.
program for Grundy silt loam, Iowa 620.
treatise, 317.
microbiology, N.J. 810.
moisture—
determination, method, Tex. 615.
effect on strawberries, Ala. 434.
experiments in prairie provinces, Can. 825.
organic matter, formation, Fla. 416.
profiles, colloidal materials in, U.S.D.A. 18.
profiles, preparation for exhibition and study, N.Y.State 17.
properties, single valued, interrelationships, 419.
sampling tube, improved, 811.
science, handbook, 714.
solutions, preparation, for determinations of total and filtrable manganese and phosphorus, 312.
survey in—
Arizona, Salt River Valley area, U.S.D.A. 116.
California, Clear Lake area, U.S.D.A. 619.
Colorado, Arkansas Valley area, U.S.D.A. 208.
Illinois, Effingham Co., Ill. 117.
Illinois, Piatt Co., Ill. 117.
Iowa, Iowa 17.
Iowa, Buchanan Co., U.S.D.A. 208.
Iowa, Lyon Co., U.S.D.A. 208.
Kansas, Clay Co., U.S.D.A. 16.
Kansas, Crawford Co., U.S.D.A. 417.
Kansas, Labette Co., U.S.D.A. 17.
Michigan, Tuscola Co., U.S.D.A. 116.
Minnesota, Wadena Co., U.S.D.A. 16.
Mississippi, Claiborne Co., U.S.D.A. 16.
Mississippi, Rankin Co., U.S.D.A. 16.
Montana, Hill Co., Mont. 715.
Nebraska, Custer Co., U.S.D.A. 715.
Nebraska, Franklin Co., U.S.D.A. 17.

Soil—Continued.
survey in—continued.
Nebraska, Hamilton Co., U.S.D.A. 117.
Nebraska, Lincoln Co., U.S.D.A. 715.
New Jersey, Camden area, U.S.D.A. 116.
New Mexico, Deming area, U.S.D.A. 117.
New York, St. Lawrence Co., U.S.D.A. 417.
Ohio, Butler Co., U.S.D.A. 619.
West Virginia, Hampshire Co., U.S.D.A. 117.
Wisconsin, Manitowoc Co., U.S.D.A. 417.
temperature in plant container, effect of structure and moisture, 323.
temperatures in United States, U.S.D.A. 316.
types, comparison, Ala. 415.
types, fertilizer experiments, N.Y.Cornell 621.
water, *see* Soil moisture.
Soils—
acid, *see* Soil acidity.
alkali, *see* Alkali.
ammonification, *see* Ammonification.
base exchange studies, N.J. 811.
buffer action, nature, 812; *Ala.* 415.
carbonates in, determination, new method, 505.
degree of saturation with bases, measurement, Iowa 619.
desert, humus in, methods of study, Nev. 720.
dispersion by supersonic method, 716.
exchangeable bases in, determination, 506.
exchangeable cations of, and plants, 812.
field percolation rates, U.S.D.A. 19.
flow plasticity, conception, 513.
fungus flora of, 320.
Hawaiian, physical properties, Hawaii 715.
inoculation, *see* Legumes, inoculation.
market garden, nitrates in, 514.
mineral deficiencies in, Neubauer method for determining, 19.
moor, *see* Peat.
muck, *see* Muck soil.
nitrate assimilating power, Iowa 20.
nitrite production in, Tex. 813.
nitrogen content, *see* Ammonification, Nitrification, *and* Nitrogen.
nutrient availability, pH and base exchange, correlation, Vt. 513.
nutrient deficiencies, diagnosis by plant symptoms, 322.
of Cass and McHenry Counties, composition, N.Dak. 618.
of Montana, phosphate deficiency in, Mont. 19.
of Wayne County, classification, Ill. 811.
Soils—Continued.
organic matter in, *see* Organic matter
peat, *see* Peat.
percentage base saturation, determination and value, 209.
physical properties and bearing value, *bibliography*, 879.
physical properties, indexes, Ala. 476.
podsolic process in, 819.
rôle of the rarer elements in, 628.
secular and seasonal changes in, Calif. 318.
sour, modification, R.I. 511.
studies, Calif. 718; Fla. 416; Utah 207.
tilth, factors affecting, Nebr. 809.
treated with various cations, effect of dilution on pH, 811.
uronic acids in, 505.
volume-weight determination, methods, 715.
Solar—
energy for heating water, equipment for utilizing, Ala. 476.
radiation in Colorado, annual variation, 97.
ultra-violet radiation in Baltimore, annual variation, 96.
Soldier bug, spined, on celery leaf tyer, 53.
Solutions—
formation, temperature changes in, 309.
nutrient, *see* Culture media.
Sorghum—*see also specific kinds.*
and corn, drought resistance, comparison, 223.
effect of seed treatment, 333.
effect on following crop, Calif. 727.
grain, seeding and spacing experiments, Tex. 332.
grain, variety tests, N.Mex. 221.
varieties, forage yields, V.I. 730.
Sorgo—
variety tests, N.Mex. 221; Nebr. 822.
water requirements, 128.
Sorosporium paspali, notes, 441.
South Carolina—
Agricultural Loan Association, analysis, U.S.D.A. 682.
Station, history, editorial, 405.
Station, history, notes, 496.
South Dakota—
College, notes, 700.
State College, history, treatise, 189.
Soviet Institute for Plant Protection, establishment, 600.
Sows—*see also* Pigs.
blood, *Brucella abortus* agglutinins in, 269.
brood, ration for, Ind. 162.
Soybean—
forage, feeding value, S.C. 661.
hay, feeding value for hogs, Ala. 461.
hay, intermediate v. late, for milk and fat production, Ind. 169.
oil meal, effect on pork quality, Ill. 867.

Soybean—Continued.
seeds, germination, transformation of nitrogenous compounds during, 24.
Soybeans—
as corn supplement, Ind. 158.
as hay crop, Ala. 331.
as protein supplement for pigs, Del. 763.
breeding, N.C. 126.
culture experiments, N.C. 126.
effect on pork quality, Ill. 367.
fertilizer experiments, N.C. 126, 127.
for hay, fertilizers for, N.C. 115.
for hay, variety tests, N.C. 126.
for seed, variety tests, N.C. 126.
ground, v. linseed meal for heifers, Ind. 169.
harvesting, low cutting attachments for combines, Ind. 182.
inoculation, effect, Iowa, 125.
irradiation by ultra-violet light, effects, Mich. 722.
lodging, 35.
mineral deficiencies, Ind. 158.
reducase in, effect of length of day, N.J. 829.
sprouted, as sole diet, effect on blood of hens, 367.
use in livestock feeding, Ill. 255.
utilization, Ind. 108.
variety tests, Mass. 330; Miss. 31; Tenn. 825.
Spartina townsendii, origin, 819.
Spasmophilia, adult, in India, 398.
Spavin in horses, radiographic and pathohistologic study, 869, 870.
Species—
concept, formulation, 520.
specificity, relation to differentiation, 218.
Spermatogenesis in ground squirrel, 218.
Spermatozoa—
from posterior and anterior end of epididymis, comparison, 218.
human, transformation period, diagrams, 122.
motility in portions of male reproductive tract of rats, 426.
transportation in rats, 27.
Spermophagus subfasciatus, morphology and biology, 551.
Sphaceloma fawcettii, development, 447.
Sphaerella heveae, notes, 344.
Sphaeridium species from Orient, 546.
Sphaerotheca—
humuli conidia, germination, 442.
pannosa conidia, germination, 442.
Sphenophorus maidis, *see* Corn billbug.
Spider mite, green, studies, Fla. 452.
Spiders, red, *see* Red spider.
Spillman, W. J., editorial, 601, 604.
Spilographa alternata, notes, 246.
Spinach—
dried, in tightly closed jar, vitamin A in, 193.
fertilizer experiments, R.I. 534.
vitamin B complex in, 590.
Spirochaeta ictero-uraemiae canis, notes, 567.
Spirochetes in chickens, 73.
Spirochetosis of fowls in Northern Caucasus, 777.
Spironema caeci-gallorum n.sp., description, 73.
Spiruroidea, parasitic in poultry, developmental stages, U.S.D.A. 181.
Spittle bug, notes, Me. 757.
Splenectomy, effect on fowls, 674.
Spodoptera mauritia, notes, 56.
Sponges, diamino acids in, 310.
Spray—
materials, fungicidal properties, 537.
materials, waste sulfite as emulsifying agent, Va. 40.
outfit for applying small quantities of material, 847.
procedures, new, 50.
residue problem of fruits, Mass. 355.
residue removal, experiments, 52.
residue removal from apples, 230, 342; N.J. 833; Ohio 638; Va. 739.
residue removal, summary, 454.
schedules for New Jersey, N.J. 42.
Sprayer accessories affect efficiency of equipment, Mich. 478.
Spraying experiments, Mo. 340.
Sprays—*see also* Insecticides, Fungicides, *and specific forms*.
oil—*see also* Oil.
pyrethrum containing copper oleate, effect on apple trees, N.J. 849.
summer oil, effect on apple trees, 51.
Spring materials, elastic behavior, 76.
Spruce—
and pine, growth differences on poor soil, 342.
black v. white, growth rate, Mich. 742.
gall aphid as nursery pest, 455.
gall aphid, control, 51; N.Y.Cornell 53.
mite, notes, Mich. 153.
needle miner, control, N.J. 850.
reproduction, effect of soil moisture, 836.
seeding experiments, Ind. 141.
Sitka, layering habit in, 643.
Spurge, leafy, as weed pest, Iowa 125.
Squash, changes in carbohydrate content, 227.
Squash vine borer, studies, Conn.State 549.
Squirrels—
ground, germ cells and somatic tissues, 218.
male genital apparatus, 217.
Wyoming ground, life history studies, Colo. 650.
Staggerweeds, poisonous to livestock, Ind. 70.
Stalk borer, striped, injury to sugarcane, 355.
Stalk borers, life history and habits, Iowa 153.
Stomoderes uniformis, life history studies, Calif. 753.

Standards of living, rural, *bibliography*, U.S.D.A. 786.
Staphylococcus—
aureus—
bacterin, immunization with, Mich. 176.
effect of hydrogen peroxide, Wis. 471.
pyogenes and *Bacterium coli*, mixed *cultures, changes in* pH, 568.
Staphylococcus cultures at fever heat, effect of charcoal on pH of, 567.
Starch—
in flour, determination, 13.
storage in seeds, Iowa 119.
Starling, European, sexual cycle in, 726.
Statistics, mathematical theory of, elements, treatise, 678.
Steel, stainless—
corrosion rate in vinegar, Calif. 709.
solubility in milk, Wis. 469.
Steels, spring, elastic behavior, 76.
Steers—*see also* Cattle, beef.
cost of wintering, Fla. 460.
effect of feeding peanuts and velvetbeans, Ga. 158.
fattening, papers on, 254.
fattening, rations for, Iowa 159.
feeding methods, Wis. 460.
predicting gains in, 759.
winter feeding and time of marketing, Ala. 459.
Stemphylium solani n.sp., notes, 439.
Stephanitis rhododendri, sprays for, 50.
Stephanitis spp., infestation, relation to vigor of plant, 454.
Stephanopholis philippinensis in Negros, 551.
Stephanurus dentatus of swine, 776.
Sterility—
in cattle, 567.
in guinea pigs, inherited type, Wis. 425.
in young heifers, etiology, Iowa 170.
Sterilization methods, research in, Fla. 454.
Sternochetus weevils, synonymy, 552.
Stictocephala festina, notes, Ala. 455.
Stilpnotia salicis, spread, Conn.State 451.
Stink bug, lychee, biological study, 757.
Stock, *see* Livestock.
Stock foods, *see* Feeding stuffs.
Stocks, effect of liming, Mass. 339.
Stomach worms—
control by sanitation and drenching, N.C. 179.
in sheep, treatment, Mich. 175.
Stomata, opening in different wave lengths of light, 215.
Stomoxys nigra, transmission of surra by, 56.
Stone cells of pears, Mich. 739.
Stonefly, new species, 546.
Straussia longipennis, notes, Conn.State 451.
Straw—
breaking strength, instrument for testing, 784.
Straw—Continued.
cellulose determination in, 314.
Strawberries—
aphis resistant varieties, breeding, 640.
breeding, Tenn. 830.
cold-packed, microflora, Calif. 768.
culture, Tenn. 830.
effect of irrigation, Oreg. 740.
fertilizer experiments, Ind. 134; N.C. 136.
greenhouse, nutrients for, N.J. 832.
quality, effect of rainfall, Ala. 434.
respiration studies, 640.
shipments, Fla. 481.
shipments from Florida and competing areas, Fla. 880.
varieties, Nebr. 829.
variety tests, N.C. 136; Tenn. 830.
Strawberry—
black root, notes, Tenn. 840.
chlorosis, notes, N.J. 832.
crown moth, studies, Calif. 53.
disease, notes, Fla. 439.
plants, carbohydrate composition, 231.
plants for establishing new beds, N.J. 832.
plants, mineral deficiencies, 25.
root weevil, control, 552.
root weevil, notes, Mich. 153.
rootworm, studies, Calif. 53.
seedlings, tests, N.J. 832.
weevil, notes, Conn.State 451.
weevil, rough, studies, Calif. 53.
Streptococci—
in scarlet fever, rôle in domestic animals, 266.
relation to encephalitis of fox, 271.
Streptococcus—
epidemicus, notes, Wis. 471.
epidemicus of monkeys and cows, experimental infection, 70.
lactis strains, variations in, 564.
Stripe rust in Alberta, 537.
Student's method and Bessel's formula, comparison, 31.
Stumpage and log prices for 1928, U.S.D.A. 43.
Sucrose—
v. honey in bread making, 394.
value for preservation of eggs by freezing, 411.
Sudan grass—
as pasture crop, Mich. 634.
culture experiments, N.Mex. 221.
cutting experiments, Ala. 428.
hay, yield and protein content, effect of nitrates, Ala. 429.
in orange orchards, effect on coloring of fruit, Calif. 735.
pasture, supplementing for dairy cows, Ind. 169.
water requirements, 128.
Sugar—*see also* Sugars.
beet—*see also* Beet.
curly top resistant strains, Calif. 729.
leaf spot, control, Iowa 145.

Sugar—Continued.
- beet—continued.
  - root rot, relation to soil fertility, 843.
  - seed, annual production, N.Mex. 221.
- beets—
  - blocking and spacing experiments, Calif. 728.
  - culture, Utah 226.
  - culture experiments, Wyo. 127.
  - culture in eastern England, returns from, 385.
  - experiments in England, 225.
  - insects affecting, 52.
  - overwintered in field, seed production from, U.S.D.A. 36.
  - plowing depths and fertilizers for, Mich. 433.
  - research work in England, 482.
  - seeding experiments, Calif. 728.
  - transplanting, U.S.D.A. 35.
  - variety tests, N.Mex. 221.
  - variety tests in Czechoslovakia, 530.
  - water requirements, 128.
  - yields and sugar content, Utah 222.
- in blood, *see* Blood sugar.
- in cottonseed, variation during growth, 631.
- industry of Louisiana, decline and renaissance, 531.
- manual of Porto Rico, 633.
- statistics, U.S.D.A. 486.

Sugarcane—
- breeding, 531; V.I. 729.
- brown stripe in Cuba, 46.
- disease in Porto Rico, 349.
- diseases in Philippines, 644.
- diseases in Queensland, 441.
- eye spot fungus, toxic substance produced by, 238.
- eye spot in Cuba, 46.
- gummosis, notes, 46, 348.
- in Mauritius, beetle grubs attacking, 361.
- industry, papers on, 530.
- insects affecting, 246, 355, 657, 756.
- insects, parasites of, in Negros, 547.
- leaf spot, notes, 344.
- mosaic in Barbados, 446.
- mosaic, notes, 441.
- mottling disease, *see* Sugarcane mosaic.
- pests, control, 59.
- planting tests, U.S.D.A. 132.
- pokkah boeng and twisted top in Cuba, 349.
- propagating, interregional movement, relation to quarantine, 530.
- roots, studies, La. 828.
- seedling selection work, use of refractometer, 86.
- Technologists, International Society, proceedings, 530.
- variety tests, 531; Miss. 31; U.S.D.A. 132; V.I. 729.

Sugarcane—Continued.
- yellow stripe, *see* Sugarcane mosaic.

Sugars—*see also* Lactose, Sucrose, *etc.*
- reducing, determination, cupro-potassium carbonate solution in, 508.
- storage in seeds, Iowa 119.

Sulfate—
- of ammonia, *see* Ammonium sulfate.
- of potash, *see* Potassium sulfate.
- water, effect on concrete, U.S.D.A. 575.

Sulfhydryl compounds, oxidation-reduction potentials, 204.

Sulfides, quantitative precipitation in buffered solutions, 614.

Sulfite pitch, properties and uses, Va. 40.

Sulfonic acids and thiol acids, simultaneous production from dithio acids by silver sulfate, 203.

Sulfur—
- effect on alfalfa, Mont. 528.
- flotation, in spray combinations, value, Mass. 354.
- fungicidal property, factors affecting, 537.
- fungicides, greenhouse experiments, Wis. 440.
- mixtures, *see* Lime-sulfur.

Sun spots, relation to atmospheric pressure and precipitation, 714.

Sunflower—
- maggot, notes, Conn.State 451.
- weevil parasite, notes, 456.

Sunlight—*see also* Light.
- direct, effect on egg production and hatchability, Calif. 764.
- winter, effect on rickets in growing chicks, 258.

Sunshine—
- in Colorado, high antirachitic potency, 96.
- winter and summer, in Colorado, antirachitic effects, 96.
- winter, in southern Wisconsin, ultraviolet potency, Wis. 463.

Sunt die-back, notes, 246.

Superphosphate—
- ammoniation, reactions during, 421.
- effect on flax, 529.
- variations in local prices, Mo. 485.

Surra—
- control in Dutch East Indies, 70.
- in Mauritius, transmission, 56.

Swallows of New Jersey, N.J. 448.

Swede—
- dry rot, notes, 345.
- false club root, notes, 345.

Swedes, maggot injury, Me. 749.

Swedish Central Agricultural Experiment Station, notes, 700.

Sweet corn—
- bacterial wilt, notes, Ind. 143.
- hybrids, studies, Ga. 123.
- paper mulch experiments, Ohio 435; R.I. 534.
- planting dates, relation to borer infestation, 56.

Sweet corn—*Continued.*
seed, germination, effect of disinfectants, 44.
variety tests, Ala. 434.
yellow varieties, yields, R.I. 534.
Sweet pea diseases, N.J. 352.
Sweet peas, cooperative cultural and varietal tests, N.Mex. 227.
Sweetclover—
as hay crop, 254.
as honey plant, Iowa 153.
biennial, as pasture crop, Conn.Storrs 727.
cross, inheritance of flower color in, 522.
culture experiments, Wyo. 127.
culture under dry farm conditions, Utah 627.
diet, effect on calcium in blood serum, 363.
disease, effect on blood coagulation, 267.
hay, poisonous to livestock, Ind. 70.
inheritance of dwarf branching habit, 325, 424.
plowing under for green manure, Iowa 124.
seeds, hard, studies, 39.
variety tests, Wyo. 127.
white flowered, seed color markings, 531.
Sweetpotato—
black rot, control, 349; N.C. 147.
black rot, disinfectants for, 647.
black rot resistance, varietal variation, Ala. 437.
diseases, relation to soil type, N.C. 147.
pox or soil rot, cause, 749.
scurf, control, N.C. 147; N.J. 839.
sprouts, time of applying fertilizers, N.C. 126.
stem rot, control, 349, 540.
Sweetpotatoes—
breeding, V.I. 729.
Diplodia spp. affecting, Fla. 439.
effects of chilling temperatures, 636.
fertilizer experiments, Miss. 31; N.C. 126.
prices, production, and acreage, factors affecting, Mo. 387.
selection, Miss. 31.
variety tests, N.Mex. 221; Tenn. 825; V.I. 729.
Swifts of New Jersey, N.J. 448.
Swine—*see also* Pigs.
breeding by artificial insemination, 27.
diseases, changes of lungs in, 868.
inbreeding, 254.
influenza, etiology, 674.
Swiss chard, moisture fluctuations in, 214.
Symptomatic anthrax, *see* Blackleg.
Synanthedon bibionipennis, studies, Calif. 53.
Synchytrium endobioticum, notes, 347.
Synthetocaulus rufescens, life history, 548.
Syrphidae of Egypt, 57.
Tabanidae—
of China, 546.
of Egypt, 57.
Talc dust, insectary tests, N.J. 848.
Tamarack, *effect of defoliation*, 342.
Tangerine trees, bark scaling and exf tion, Fla. 438.
Taniva albolineana, control, N.J. 850.
Tankage—
addition to ration of pigs, effect, M 763.
feeding value, relation to protein tent, Ind. 162.
v. meat scrap with half corn pou ration, Ind. 167.
v. protein concentrates for pigs, 162.
variations in local prices, Mo. 485.
Tapeworm—
fringed, pathogenicity, 178.
in turkeys, control, Mich. 772.
large, in turkeys, treatment, Mich.
of sheep, life history, 752.
Tapioca meal, feeding value for pigs,
Tariff rates on agricultural products acts of 1930 and 1922, U.S.D.A. 783.
Tarnished plant bugs—
as vectors of potato diseases, N 348.
on beans, 50.
Tarsonemus latus, notes, Conn.State
Tax—
burdens of farmers, relief for, 79.
conference of national organizati report, 683.
delinquency in Oregon and Washing U.S.D.A. 186.
problem, rural, in Pennsylvania, 277.
situation in Illinois, 388, 389.
system of Virginia, reconstruct 585.
Taxation—
equality, relation to assessment sy of Minnesota, 276.
farm, problem and method of st 888.
forest, State laws, digest, U.S. 343.
in Delaware highway finance, Del.
of farm lands, defects of sale valu basis for, 389.
of farm property, N.J 882; Ohio
of farm real property, valuation, 7
problems in economically deca areas of New York State, 584.
Tea—
diseases, notes, 344.
plant, complete removal of the le effect, 240.
root disease, control, 241.
wood rot, relation to pruning, 241.
Teaching—
method in, psychological basis, 88
procedure, methods of improving,

Teeth, mottled enamel in, 396; Ariz. 596.
Temperature—*see also* Climate *and* Soil temperatures.
effect on corn yields in Kansas, 510.
effect on milk production, 371.
extremes in Wisconsin, 510.
low, injury to fruit trees, 26.
yearly variations over west Pacific, 617.
Tenancy problems in Japan, 79.
Tenebrio molitor, see Mealworm, yellow.
Tennessee Station, notes, 799.
Tennessee Station, report, 899.
Tennessee University, notes, 100.
Tepary bean hay v. cowpea hay for cattle, Okla.Panhandle 171.
Termites—
destructive to wood, control, 546.
in buildings, notes, Mich. 153.
notes, 548; Ohio 852.
problem in Pacific Area, 756.
protection of timber against, 246.
Terrace construction, need of improved machinery, 274.
Terracing—
machinery, types used in Texas, 275.
studies, Ind. 182.
Tessaratoma papillosa, biological study, 757.
Testis grafts in bilaterally ovariotomized fowl, 218.
Tetany, induction in rachitic rats, 794.
Tetrachlorethylene as anthelmintic, 874.
Tetracnemus pretiosus, parasite of citrophilus mealybug, Calif. 755.
Tetrameres americana, developmental stages, U.S.D.A. 181.
Tetranychus—
bimaculatus, studies, Fla. 452.
pacificus, notes, Calif. 753.
telarius, see Red spider.
Texas Cotton Growers' Finance Corporation, report, U.S.D.A. 682.
Texas fever, *see* Piroplasmosis, bovine.
Texas Station bulletins and circulars, abstracts, 899.
Textile—*see also* Fabrics.
fibers, microscopy, 195.
Thallium—
pharmacology and use in rodent control, U.S.D.A. 151.
salts, effect on molting mechanism of fowls, 764.
Theileriosis, bovine, transmission in North Africa, 776.
Thelastoma—
macramphidum n.sp., description, 361.
papilliferum n.sp., description, 361.
Thermometers, resistance, to measure relative humidity, 808.
Thespesia populnea, cell division in root-tip, behavior of nucleus, 520.
Thielaviopsis paradoxa—
notes, 344.
perfect stage of, 585.
Thiocyanates, effect on iodine-starch reaction, 813.
Thioglycollic acid, oxidation-reduction potentials, 204.
Thiohydantoins—
action of alkali on, 11.
from cystine and cysteine, 11.
Thiol acids and sulfonic acids, simultaneous production from dithio acids by silver sulfate, 208.
Thistle, Russian, water requirements, 128.
Threshing, use of electricity in, Ind. 183.
Thrips in citrus groves, infestation, Fla. 451.
Thrips tabaci, see Onion thrips.
Thrush, pathogenesis, 869.
Thymectomy, effect on growing chickens, 220.
Thymus glands, removal, effect on fowls, 220.
Thyroid glands, effect of iodized milk and potassium iodide, 97.
Thyroid, relation to feather growth and character in fowls, 626.
Thysanoptera, injurious to wheat, 651.
Thysanosoma actinioides in sheep, pathogenicity, 178.
Tick—
parasite work, review, 546.
toxin and tick paralysis, 773.
Ticks—
and other animal pests of medical importance, relation to public health, 244.
and tick-borne diseases, 773.
transmission of relapsing fever by, 657.
Tile drainage, *see* Drainage.
Tile roof, waterproofing, Iowa 183.
Tilletia tritici—*see also host plants.*
in wheat, new physiologic forms, 236.
Timber—*see also* Lumber *and* Wood.
in buildings, insects emerging from, 355.
privileges in national forests in Utah, U.S.D.A. 141.
protection against termites, 246.
Timbers, home grown, structure, relation to properties, 233.
Timothy—
effect on following tobacco crop, Wis. 333.
infusion, effect on tobacco, 47.
varieties, behavior, N.J. 31.
variety tests, N.J. 824.
Tin coated metals, solubility in milk, Wis. 469.
Tiphia popilliavora, parasite of Japanese beetle, U.S.D.A. 157.
Tiracola plagiata, studies, 248.
Toads as predators of wireworms or click beetles, 551.
Tobacco—
bacterial leaf spot, notes, Tenn. 840.
beetle, life history and control, 758.
black fire, notes, Tenn. 840.
black root rot—
and soil reaction, 239.
resistant strains, Mass. 344.
studies, Mass. 343; Tenn. 840.

Tobacco—Continued.
black shank in Porto Rico, 349.
breeding, Fla. 429.
brown root rot, effect of timothy infusion, 47.
brown root rot, studies, Mass. 343; Wis. 334.
chromosomal chimera in, 522.
cigar, effects of lime, 46.
cigar leaf, burning qualities, Conn. State 336.
cigar leaf, of Pennsylvania, composition and quality, 226.
cigarette, plight of, 886.
culture experiments, Fla. 429.
curing, changes occurring during, Conn.State 36.
curing experiments, 531; Conn.State 336; N.C. 126.
effect of osmotic pressure, 213.
enzymes, studies, 712.
fertilizer experiments, 531; Fla. 429; Mass. 337; N.C. 126.
fertilizer losses through leaching, Conn.State 336.
fertilizers, fractional application, Conn.State 335.
following timothy, factors affecting growth, Wis. 333.
growing in Gujarat, improvement, 531.
insects affecting, Conn.State 336, 356.
leaf thickness, Wis. 431.
leaves, differently aged, properties, 216.
leaves, nonvolatile organic acids, Conn.State 9.
leaves, shade, burn tests, Fla. 430.
mixed seed problem, Wis. 432.
mosaic—
control, 47.
effect of curing process, N.C. 145.
intracellular inclusions in, 645.
local lesions in, 750.
outbreaks, 648.
strains in Kentucky, 239.
studies, Wis. 431.
studies, inoculating methods, 843.
virus, attenuation, 645.
virus, concentrations, accuracy in comparing, 47.
virus, studies, 843.
virus, transmission experiments, 248.
nitrogen sources, Conn.State 335; Mass. 337.
organization, progress in, 585.
plant, chemical investigations, Conn. State 9, 36.
plant, development, effect of topping and suckering, Conn.State 336.
potash fertilizer experiments, Conn. State 334.
ring spot, 47.
root rot, black and brown, factors affecting, 239.
seed beds, sterilization, Mass. 343.
seed, germination, Wis. 182.
Tobacco—Continued.
seeds, weight, effect of plant trimming, Conn.State 336.
sheds, heating, use of coke in, Conn.State 337.
stalk, fire-curing tests, Conn.State 337.
statistics, U.S.D.A. 486.
thrips on narcissus, Fla. 451.
variety tests, N.C. 126.
virus diseases in Kentucky, 239.
wild, mosaic, in Canary Islands, 645.
wilt, studies, N.C. 146.
Tomato—
bacterial canker, studies, 446; Ind. 144; Wis. 441.
blight, early, control, Ind. 144.
curly top, resistance, Calif. 723.
diseases in Tennessee, 350.
eelworm, notes, 345.
fungus disease, control, Fla. 439.
Fusarium wilt resistant varieties, Ga. 142; Mich. 745.
juice manufacture, retaining vitamins in, 613.
leaf mold in greenhouse, effect of air circulation, Mass. 344.
mosaic, soil transmission in greenhouse, 540.
mosaic virus, combining with potato virus, Ind. 144.
nailhead spot, control, Fla. 439.
peroxidase, inactivation temperature, effect of pH, 214.
plants, time of planting, N.Mex. 227.
pockets, classification of symptomatic types, 843.
products, vitamins in, 293.
pulp, color, effect of vegetative conditions of plants, N.J. 831.
pulp, dried, vitamin A in, 193.
pulp, vitamin A in, Wis. 492.
seed, Marglobe, production, V.I. 738.
seeds, treatment, N.J. 838.
Septoria leaf spot, control, Ind. 144.
spotted wilt, notes, 345.
stems inoculated with *Bacterium tumefaciens*, rate of migration in, 47.
streak, experiments, 648.
streak, soil transmission in greenhouse, 540.
vines injured by a mirid, 50.
virus from tissue of diseased plants, obtaining, Ind. 144.
wilt, notes, 344.
wilt, studies, N.C. 146.
worm, insecticide efficiency for, factors affecting, 357.
Tomatoes—
breeding, N.J. 831.
canning, fertilizer experiments, Mich. 719.
cultivation experiments, N.Y.Cornell 635.
development, effect of removal of alternate flower clusters, 227.

matoes—Continued.
effect of manganese, Fla. 434.
effect of paper mulch, R.I. 534.
fertilizer experiments, Miss. 39; R.I. 534.
greenhouse, production, Wis. 40.
irradiation by ultra-violet light, effects, Mich. 722.
paper mulch experiments, Ohio 435.
reducase in, effect of length of day, N.J. 829.
respiration, 215.
ripening with ethylene gas, 534.
shipments, Fla. 481.
shipments from Florida and competing areas, Fla. 886.
shipments to New York City, returns from, V.I. 737.
storage, acidity and color changes in, 340.
varieties, characteristics, Tenn. 830.
variety tests, Miss. 39.
vitamin C in, Hawaii 793.
yields, effect of source of potash, R.I. 526.
yields, increasing, Ind. 134.
rulin—
curative value for pigeons and rats, 593.
purified, precipitation, relation to pH, 502.
relation to maintenance nutrition in pigeons, 593.
umeyella liriodendri, control, 50.
wn and country people, interdependence and association, Mich. 784.
rocara canis ova, development and survival, Minn. 151.
rotrypana curvicauda, *see* Papaya fruit ly.
acheitis, infectious—
effect on agglutinins in blood, 270.
in poultry, Mass. 375, 474.
actor lug studies, Ala. 476.
actor work on farms, cost, 389.
actors—
and implements, mechanical tests, Mont. 576.
garden, in truck garden industry of Long Island, 274.
general-purpose, corn production studies with, 577.
tests, Nebr. 676.
tracklaying and wheel types, power losses, Mich. 778.
use on farms, Ind. 185.
wood gas, tests, 880.
de, foreign, in agricultural products, tatistics, U.S.D.A. 486.
nsportation rate policies, rôle in mareting problems, 888.
vel to conferences, meetings, etc., nuerous demands for, 889.
stocks, relation to winter injury and evention, Oreg. 534.
wounds, disinfectant for treating, alif. 785.
Trees—
evergreen, *see* Evergreens.
for Wyoming, methods of planting and culture, Wyo. 233.
forest, diseases caused by meteorological conditions, U.S.D.A. 15.
forest, seed source, significance, 642.
forest, thinning, effect on diameter growth, Vt. 436.
hardwood, manufacture of dimension stock from, U.S.D.A. 437.
height determination, apparatus, 342.
shade, pests and control, N.Y.Cornell 58.
windbreak—
establishing, Mich. 742.
for orchards, Okla.Panhandle 341.
planting and care, Wyo. 739.
Trematodes from a duck, 353.
Treponema cacci-gallorum n.sp., description, 73.
Trialeurodes vaporariorum, *see* White fly, greenhouse.
Tribolium confusum, growth and development, 248.
Trichoderma in soil flora, 320.
Trichogramma, control of pests by, complications, 856.
Trichogramma minutum—
artificial rearing and colonization, 458.
for control of orange tortrix, Calif. 756.
temperature relations as basis for identification, Calif. 361.
Triethanolamine emulsions, 52.
Trinity mixture, feeding value, Iowa 163; Wyo. 166.
Trioza alacris, notes, 247.
Trogoderma versicolor in dried sweet corn, Mich. 756.
Truck crop—
area, new, economic report, S.C. 83.
competition in Florida, inter-State and foreign, Fla. 886.
Truck crops—
aphids affecting, Va.Truck 156.
shipments, Fla. 481.
Trucks, *see* Motor trucks.
Trypaneidae of Egypt, 57.
Trypanosoma evansi—
blood sugar of animals infected with, 570.
development in mice, 266.
Tryptophane splitting off from casein digested with papain-cyanohydrin, 711.
Tubercle bacilli—
cultivation, Hohn's method, 567.
cultures, ammonium malate as source of nitrogen for, 773.
synthetic media, dextrose in, 773.
Tuberculosis—
avian—
in cattle, 269.
in dogs, histopathological study, 570.
in striped gophers, 570.
in swine, 567.

Tuberculosis—Continued.
bovine—
blood picture, 869.
organism, culture medium for, 570.
serological diagnosis, 869.
studies, Wis. 470.
eradication campaign, cooperative, in United States, status, 267.
immunization with B.C.G. vaccine, 571; Calif. 770.
of birds, Wyo. 176.
of cattle, skin form, relation to the disease in chickens, Wyo. 176.
of livestock, papers on, 267.
of poultry, Iowa 179.
of reproductive organs of bovine, 869.
prevention, newer aspects, 267.
Tularemia—
from a fox squirrel in Illinois, 70.
in British Columbia, 267.
in sheep and wild animals, 472.
Tulip—
diseases, notes, 542; N.J. 352.
honey, formic acid in, 408.
Tulips—
breaking in, relation to aphids, 247.
variety tests, N.C. 136.
Tuliptree scale, control, 50.
Tumors—
on feet of wild birds, Mich. 475.
so-called, studies, 870.
spontaneous, in mice, origin, 217.
Tuna fish oil, comparison with cod-liver oil as to vitamin content, 397.
Tung oil—
as anthelmintic, 874.
branches, *Diplodia* spp. affecting, Fla. 439.
trees, fertilizer experiments, Fla. 435.
Turf, management, 628.
Turkey—
breeds, color factors in crosses, revised terminology, 328.
poults, protein requirements, Calif. 764.
Turkeys—
breeding for high fecundity, Calif. 764.
crooked breast bones in, Nev. 662; Wyo. 168.
Eimeria spp. affecting, 876.
feed consumption and growth rate, Ind. 167.
production, Nebr. 862.
raising in Texas, 561.
Turnip aphid, life history, habits, and control, Va.Truck 156.
Turnips—
effect of preceding crop, R.I. 527.
maggot injury, Me. 749.
Turpentining, French system v. American, 343.
Tuskegee Institute, notes, 497.
Twinning, relation to delayed implantation in mammals, 218.
Twins—
finger prints, comparison, 220.
Twins—Continued.
in human births, relation to latitude, 725.
production, inheritance, Wis. 425.
Tylenchinema oscinella, life history and effect on host, 360.
Tylenchus dipsaci, notes, 542.
Typhlocyba—
comes, see Grape leafhoppers.
pomaria, notes, 54.
pomaria spotting of apples, removal 52.
Typhoid, avian, see Fowl typhoid.
Typhus fever, transmission by fleas, 657.
Typhus-Rocky Mountain spotted fever group, 59.
Tyrosinase, mode of action, 311.
Tyrosine splitting off from casein digested with papain-cyanohydrin, 711.
Udder streptococcus infections, 259.
Udder streptococcus infections, vaccination for, Mich. 175.
Udders—
bacterial flora before and after death of cow, 378.
bacteriology and pathology, Mich. 70.
of cows, histopathology and bacteriology, Mich. 771.
Ultra-violet—
absorption spectrum of liver oils, 804.
irradiation—
effect on calcium metabolism of women, Mich. 794.
effect on frequency of colds, 897.
effect on soybeans and tomatoes, Mich. 722.
excessive, effect on nutrition and endocrine glands, 695.
minimal amount for rickets, 296.
light—
effect on rickets in growing chicks, 258.
in California summer sunshine, effect on rickets, 695.
in poultry production, 560.
radiated by carbon arc lamps v. quartz mercury lamps, Wis. 462.
therapy in rickets, evaluation, 193.
Uncinula necator, notes, 345.
Undulant fever—
diagnosis, 571, 871.
paper on, 865.
relation to Brucella infection in cattle and hogs, 267.
studies, 671.
treatment with autogenous antigen, 671.
United States Department of Agriculture—
Bureau of Agricultural Economics, see Bureau of Agricultural Economics.
Bureau of Animal Industry, see Bureau of Animal Industry.
Office of Experiment Stations, see Office of Experiment Stations.
Weather Bureau, see Weather Bureau, yearbook, 1931, 496.

University—
of Cambridge, gift to, 600.
of Pennsylvania, bequest to, 600.
Urea—
as nitrogen carrier for tobacco, N.C. 126.
hydrolysis by urease, intermediate products, 12.
Urease preparations, effect of proteolytic enzymes, 712.
Uredineae, sexuality and origin of life cycles in, 444.
Uremia in dogs, cause, 567.
Urinary calculi in sheep, 254, 379.
Urine of—
chickens, collection and analysis, 556.
pregnant women, triatomic alcohol of, properties, 30.
Urocystis tritici, notes, 345.
Uromyces—
medicaginis, notes, 345.
sp. ?, notes, 345.
spp., sex mechanism in, 445.
Uronic acids in soils, 505.
Urosalpinx cinerea—
salinity death-points, 243.
trapping, N.J. 243.
Ursolic acid, identity and formula, 612.
Ustilago—
agrostis-palustris, notes, 536.
phlei-pratensis, notes, 536.
spp., notes, 345.
striaeformis, physiological forms, 536.
zeae—*see also host plants*.
notes, 441.
Ustulina zonata, notes, 537.
Utah Experimental Farm, Carbon County, report, 299.
Uterine bleeding, origin, 30.
Uterus—
contractions of bovines, registration, 567.
human, action of semen on, 27.
pregnant bovine, studies, 672.
Vaccine—
B.C.G., review of uses, 669.
bodies, Guarnieri's, studies, 870.
Vaccinia in rabbits, pathology, 571.
Vaccinium species, mycorrhiza on roots, 520.
Vacuolarium iwanowski n.g. and n.sp., proposed name, 645.
Vacuoles, contractile, in plants, 120.
Valutin as anthelmintic for horses, 870.
Vanilla flavor, studies, Calif. 768.
Variables, nomograph charts for, 580.
Veal calves, variations in local prices, Mo. 485.
Veal production, profitable market for milk, Wis. 466.
Vegetable—
diseases in Prussia, 535.
plants, fiber pots v. clay pots for, Iowa, 186.
proteins, *see* Proteins.
Vegetable—Continued.
Research Farm on Long Island, cultivation experiments, N.Y.Cornell, 635.
weevil, control, Calif. 754.
Vegetables—
baking electrically, Wash.Col. 287.
canned, determining tenderness, apparatus, U.S.D.A. 190.
canned, vitamins in, Mich. 793.
carbon dioxide storage, 412.
cooking at high altitudes, Wyo. 191, 787.
culture experiments, Nebr. 829.
fresh, proximate composition, U.S.D.A. 91.
frozen pack, temperature changes during freezing and thawing, Calif. 788.
green, manganese in, Wis. 491.
growth, effect of containers, Iowa 635.
insects affecting, Ind. 153.
inspection work, Ind. 134.
iron in, conservation by methods of preparation and cooking, Miss. 891.
leafy, vitamin B complex in, 590.
preservation by freezing, Ga. 191.
receipts at 15 Pennsylvania cities, 84.
statistics, U.S.D.A. 486.
tests, Tenn. 830.
variety tests, N.C. 137.
Vegetarian rats, growth on omnivorous diet, 692.
Velvetbeans, feeding value, Ga. 159, 161.
Venturia—
inaequalis, perithecia development, 445.
pyrina, notes, 345.
Vermicularia and Colletotrichum, identity, 535.
Vermicularia capsici, notes, Ga. 142.
Vermont Station, notes, 499.
Vermont Station, report, 598.
Vermont University, notes, 499.
Verticillium—
dahliae (?), notes, 644.
hadromycosis, nature and cross inoculations, Calif. 147.
spp., notes, 644.
Vespa crabro germana, increase in Maryland and other States, 59.
Vetch—
and rye combinations for grain hay, Idaho 222.
and wheat, feeding value, Idaho 222.
as green manure for cotton, Ga. 123.
as tobacco cover crop, Conn.State 335.
Ascochyta affecting, Ala. 437.
calcarata, for soil improvement, Calif. 727.
flowering, poisonous to livestock, Wyo. 177.
hairy, new disease on, Ala. 438.
hairy, with oats, yields, Calif. 727.
monantha, characteristics and value, U.S.D.A. 37.
sensitive joint, as forage crop, N.C. 158.

Vetch—Continued.
varieties, blooming date, Ala. 429.
variety tests, Mass. 330; Miss. 126.
Veterinary—*see also* Animal diseases.
education in Punjab, 375.
Vibrio jejuni n.sp., proposed name, 673.
Vibrios associated with intestinal disorders of cattle, 673.
Vicia faba, radiosensitivity, 26.
Village and surrounding territory, sociology, N.Y.Cornell 785.
Vine weevil, black, studies, Calif. 53.
Vinegar, analyses, Mich. 198.
Violets, North American, studies, Vt. 641.
Viosterol—*see also* Ergosterol, irradiated.
inadequate amounts, effect on healing of rickets, 893.
production, 806.
Virgin Islands Station, notes, 200.
Virgin Islands Station, report, 797.
Virginia—
College, notes, 700.
Polytechnic Institute, notes, 499.
Station, notes, 700.
Viroses, classification, 757.
Virus diseases observed by Allison V. Armour expedition, 645.
Vitamin A—
absorption and retention in young children, 295.
absorption, effect of use of mineral oil, 793.
and carotene, relation, 612; Wis. 491.
and fats, spectrographic data, 805.
and liver oils, spectrographic data, 804.
and pure carotene, 804.
antimony trichloride reaction for, 501, 806.
conversion of carotene into by fowls, 894.
deficiency, effect on monkeys, 92.
deficiency in cattle, relation to cottonseed meal feeding, N.C. 158.
deficient ration, effect on poultry, N.J. 863.
destructive action of finely divided solids, 410.
determination, 588.
experiments, diet for breeding rats for, 589.
from plant sources, behavior, 803.
from plant sources, stability, 193.
in alfalfa, as supplement to sorghum-grain rations, 363.
in alfalfa, effect of artificial drying, Ind. 158.
in canned vegetables, Mich. 793.
in corn and number of genes for yellow pigmentation, relation, 210.
in corn, relation to intensity of yellow color, Ind. 158.
in corn, variations, Tex. 294.
in fish oils, 397.
in milk of leading cattle breeds, Nebr. 262.
in oats, 397.
in tomato pulp, Wis. 492.
Vitamin A—Continued.
in tomatoes, 293.
(taurocholic acid compound), studies, 501.
Vitamin, antineuritic, isolation experiments, 805.
Vitamin B—
action, 894.
biochemical studies, 109.
complex, effect of nitrous acid, 311.
complex, factor for cure of heart block, 596.
complex nature, evidence, 397.
complex of yeast, third factor in, 94.
complex of yellow yautia and plantain, 397.
composite nature, new factor Y in, 592.
concentration and determination, 296.
deficiency—
and cod-liver oil toxicity, 95.
effect on calcium, proteins, and phosphorus in blood of dogs, 95.
in rats, pathologic changes, 494.
relation to bradycardia morals, 595.
from yeast or rice bran extracts, 311.
in canned vegetables, Mich. 793.
in cereals, Ill. 589.
in commercial liver extract, 492, 493; Ala. 493.
in infants' diets, 694.
in tomatoes, 293.
in yeast samples, 295.
relation to effect of protein-rich diets on kidneys in rats, 794.
requirement, relation to high-fat diets, Ala. 494.
specific effect on lactation, growth, and water metabolism, 793.
Vitamin B_1—
concentrate free from B_2, preparation, 613.
identity with bacterial growth-promoting factor, 93.
in leafy vegetables, 590.
of rice, curative activity, 593.
precipitation, relation to pH value, 502.
preparations, curative value for pigeons and rats, 593.
relation to maintenance nutrition in pigeons, 593.
Vitamin B_2—*see also* Vitamin G.
alcohol solubility, 502.
and bios, properties and differentiation, 296.
chemistry of, 612.
deficiency in rats, pathologic changes, 495.
deficiency, rôle in pellagra, 93.
effect of nitrous acid, 311, 612.
in cereals, 98; Ill. 589.
in egg white, 591.
in leafy vegetables, 590.
Vitamin B_3—
and bios, properties and differentiation, 296.

Vitamin B_2—Continued.
notes, 592.
Vitamin B_4—
assay, 594.
notes, 592.
Vitamin B_5, distinguishing characteristic, 594.
Vitamin C—
in apples, 895, 896.
in tomato juice, retention in commercial preparation, 618.
in tomatoes, 293.
in tomatoes and oranges, Hawaii 793.
Vitamin D—
action and identity, Iowa 193.
chemical nature, 205.
determination, line test for, 595.
effect on calcium-phosphorus metabolism, 558.
excess, relation to bradycardia in rats, 595.
in canned vegetables, Mich. 793.
in dogfish liver oil, 595.
in fish oils, 397.
mode of action, 896.
preparations, evaluation, 496.
requirements of calves, Wis. 465.
sources, comparative value, Wis. 463.
treated feed, effect on milk, 399.
Vitamin deficiency, *see* Avitaminosis.
Vitamin E in milk, Wis. 459.
Vitamin F, *see* Vitamin B_1.
Vitamin G—*see also* Vitamin B_2.
differentiation, 494.
in commercial liver extract, 492, 493; Ala. 493.
in yeast samples, 295.
relation to effects of protein-rich diets on kidneys in rats, 794.
requirement, relation to high-fat diets, Ala. 494.
stability, Ala. 492.
Vitamins—
cod-liver oil, in stored feeds, permanency, 559.
fat-soluble, functions, 205.
fat-soluble, studies, 372.
in milk, effect of nickel container for pasteurization, 92.
treatise, 587.
Vitex, Chinese, introduced into Haiti, 50.
Viviania n.spp., description, Tex. 899.
Vocational—
agriculture, training, effect on scholastic attainments, 487.
education in United States, 89.
education, progress in, 190.
Voles in Mongolia, 244.
Walking stick, woodland defoliated by, Conn.State 451.
Walnut—
bacteriosis, notes, 644.
canker disease in West Virginia, 543.
crown rot, notes, Calif. 744.
husk fly, notes, Calif. 755.
husk maggot, notes, 57.
Walnut—Continued.
trees, black, effect of dormant oil sprays, 50.
trees, composition, effect of saline irrigation water, 519.
Walnuts—
injuries in dehydration process, detection, Calif. 722.
variety tests, N.Mex. 227.
Warts on cattle, U.S.D.A. 678.
Washing—
compounds, efficiency in milk plants, 259.
machines, studies, Nebr. 898.
Washington College, notes, 100, 799.
Washington College Station, notes, 100, 499, 799.
Wasp, digger, notes, 855.
Water—
adsorbed on silica gel, density, 504.
and plant relations, 24.
and soil conservation, national program, 320.
artesian, supply of Memphis, 879.
bowls, effect on water consumption of cattle, Iowa 169.
conduction in plants, method for study, Oreg. 738.
cress, vitamin B complex in, 590.
diluting, effect on biochemical oxygen demand, 881.
exchange, total, of human being, measurement, 792.
ices, use of honey in, 488.
intake, deficient, effect on rats, 792.
power plants for farms, U.S.D.A. 74.
power resources of McKenzie River and tributaries, 575.
pressure in oak trees, 423.
requirements of crops, 127.
requirements of grasses, 822.
resources of Sandoval County, New Mexico, 778.
supplies and sewage disposal, N.J. 879.
supply—
and utilization, treatise, 878.
of Mimbres Valley, New Mexico, report, 574.
of New Jersey, report, N.J. 781.
of Pacific slope basins in California, 879.
of Pacific slope basins in Washington and upper Columbia River Basin, 879.
of United States, 1927, 476, 878.
of United States, 1928, 878.
Waterhemlock, poisonous to livestock, Ind. 70.
Watermelon—
diseases in Florida, Fla. 848.
Fusarium wilt, notes, Fla. 440.
wilt resistant varieties, 240; Iowa 145, 149.
wilt, studies, 239, 240.
Watermelons—
breeding, Calif. 736.

Watermelons—Continued.
cooperative cultural and varietal tests, N.Mex. 227.
Diplodia spp. affecting, Fla. 439.
shipments, Fla. 481.
shipments from Florida and competing areas, Fla. 886.
variety tests, Miss. 39.
Waterproofing a tile roof of a masonry arch barn, *Iowa 183.*
Wax moth caterpillars, bacteria virulent for, 650.
Weather—*see also* Meteorological observations *and* Meteorology.
Bureau, history, organization, and work, U.S.D.A. 509.
conditions at Ottawa, Can. 825.
effect of snowfall in Rocky Mountains, 616.
effect on corn yields, U.S.D.A. 617.
forecasting from humming of aerial wires, data, 111.
in Rhode Island 1890–1929, R.I. 510.
of 1930 in United States, U.S.D.A. 15.
treatise, 413.
Weather-fire service, 415.
Webworm, burrowing, damage to corn, Iowa 153.
Weeds—
control, 533; Can. 825; Iowa 125; *Mich.* 729; W.Va. 734; *Wis.* 432; Wyo. 127.
control, machinery for, Ala. 476.
control with zinc sulfate, Ind. 141.
of North Dakota, N.Dak. 338.
of Ohio, key, Ohio 338.
water requirements, 127.
Weight reduction of obese women, metabolism and insensible perspiration during, 695.
Wells, drainage, and ground water flow, 272.
West Indian Conference of Agricultural Officers, subcommittee report, 526.
West Virginia—
Station, notes, 200, 499.
Station, report, 299.
University, notes, 200, 499.
Western Farm Economics Association, *proceedings, 580.*
Wethers, show, fattening, 254.
Whale oil, absorption curves of acids, 805.
Wheat—
acreage survey, Iowa 125.
and bread prices, Ohio 481.
and rye hybrids and back crosses, genetics, 326.
and rye hybrids, studies, Ga. 123.
and vetch, feeding value, Idaho 222.
as corn substitute in animal feeding, 659.
Belt, large-scale farming, social and economic aspects, 579.
black rust in Tunis, 346.
bread, origin, 325.
breeding, N.C. 126.
bunt, *see* Wheat smut, stinking.
Wheat—Continued.
cost of production, U.S.D.A. 484.
cost of production, reducing, Okla. Panhandle, 734.
cross, correlated inheritance in, 724.
cross, endosperm development and morphologic characters in, relation, *820.*
cross, inheritance in, 325.
cross, rust reaction in, effect of temperature, 820.
cross, winter hardiness and other characters, U.S.D.A. 37.
crosses, hybrid vigor in, 624.
crosses, transfer of emmer characters to *vulgare* wheats, 325.
culture experiments, N.C. 126; N.Mex. 221; Nebr. 822; Wyo. 127.
determination of comparative yields, technic, 628.
diseases in Australia, 345.
effect of spring top-dressing of nitrogenous fertilizers, Ind. 124.
farming, dry land, in Wyoming, 580.
farming in South Australia, value of capital invested, 583.
feeding value for lambs, Idaho, 255.
feeding value for pigs, Mich. 461.
fertilizer experiments, Fla. 429; Nebr. 822.
flag smut, relation to *fertilizers, 646.*
flour, *see* Flour.
foot rot (take-all), in Kansas, 538, 539.
for fattening lambs, Nebr. 660.
for fattening yearling steers, 254.
glutelins, optical rotation, 108.
growing in Russia and United States, conditions for, 484.
growth habit and yield, effect of time of seeding, 338.
Illinois grown, quality, Ill. 782.
improvement, N.J. 824.
in Canada, production, storage, and *transportation, treatise,* 483.
insects affecting, Iowa 153.
international trade, statistics, 686.
kernel weight, effect of foreign pollen, 634.
leaf rust resistance, studies, Ind. 143.
leaf spot, notes, 441.
leaves at flowering time, water in, 214.
lodging in, Ohio 129.
lodging, relation to breaking strength of straw, 734.
loose smut, control, 539.
low priced, feeding to cows, profit *from, Okla.Panhandle 767.*
marketing, cooperative, in Western Canada, 79.
marketing in United States, 79.
Marquillo, natural crossing and self-sterility in, 538.
mosaic in Egypt, 538.
planting tests, N.J. 824.
pool, Canadian, 87.
Poso, early variety, Calif. 728.

Wheat—Continued.
powdery mildew resistant varieties, Ind. 144.
price movements, timing, 80.
price, speculation and short selling, 684.
prices and machine production, 80.
prices, materials for theory, 80.
protein in, relation to baking quality, 532.
Purplestraw, selections and hybrids from, Ga. 123.
rosette, notes, 538.
rust—*see also* Wheat stem rust *and* Rusts.
notes, 441.
physiologic forms, reactions of varieties in seedling stage, 538.
resistance, nature, 346.
rusted, harvesting at different stages, effect on yield and grade, 532.
rusts, yellow, brown, and black, incidence and intensity, 444.
seed, germination, effect of disinfectants, 44.
seed treatment, Nebr. 822.
selection work, Tenn. 840.
situation—
April to July, 1930, survey, 82.
August, 1930, to March, 1931, 681.
in Scandinavia, 681.
world, 281, 585.
world, 1929–30, 581.
smut, stinking—
breeding for resistance to, Nebr. 346.
control, 645.
in hybrids, inheritance of resistance to, 345.
new physiologic forms, 236.
notes, 345.
resistant varieties, Calif. 744.
susceptible and resistant varieties, Mich. 745.
varietal resistance, physiologic specialization and inheritance, Oreg. 747.
smutty, for poultry, Md. 862.
smutty, gas grain treater for, 880.
spring—
seed bed preparation, Wyo. 127.
seeding experiments, Idaho 222.
substitutes for northern Idaho, Idaho 226.
varieties for cut-over land, Idaho, 222.
variety tests, Nebr. 432, 822; Utah 627.
yield, effect of rolling, Idaho 222.
yield, factors affecting, 634.
stem rust—*see also* Wheat rust *and* Rusts.
resistant hybrid, Calif. 728.
strains grown in rod-row trials, statistical study, 626.
strawworm in Utah, 458.

Wheat—Continued.
stunting disease, 645.
variations in local prices, Mo. 485.
variety tests, Miss. 31; N.C. 126; N.Mex. 221; Utah 222; Wyo. 127.
water requirements, 128.
winter—
breeding, Nebr. 822.
culture under dry-farming conditions, N.Mex. 527.
pasture yield and utilization, Okla.Panhandle 129.
seed bed preparation, Wyo. 127.
seeding experiments, Idaho 222.
varieties for cut-over land, Idaho 222.
variety tests, Nebr. 822; Utah 627.
vitamins B and G in, Ill. 589.
X-ray mutations in, 325.
yields, forecasting, 111.
yields in dry farming areas, N.Mex. 222.
Wheatgrass—
crested, water requirements, 128.
western, water requirements, 128.
Whipworms, anthelmintics for, tests, 874.
White ants, *see* Termites.
White fly—
greenhouse, biological control, 361.
on cotton in Punjab, 654.
White grubs—
in pasture land, Wis. 452.
nervous system, 546.
notes, Mich. 153.
White top borer of sugarcane in Java, control, 355.
Whitewash, value as wood protector, Mich. 778.
Willow—
as prevention for shifting sand, Mich. 742.
weevil, life history studies, Calif. 753.
Willows, basket, Physalospora disease, 544.
Wind losses to farm buildings, prevention, Iowa 677.
Windbreaks, *see* Trees, windbreak.
Winter fat, culture experiments, N.Mex. 222.
Wire, aluminum alloy, elastic behavior, 76.
Wire for fences, preventing corrosion, 273.
Wireworm, Great Basin, in Pacific Northwest, U.S.D.A. 58.
Wireworms—
control, N.J. 849.
on tobacco, Conn.State 356.
predatory enemies, 551.
Wisconsin—
Station, notes, 300, 599, 700.
Station, report, 496.
University, notes, 300, 599, 700.
Witch grass, water requirements, 128.
Wojnowicia graminis, notes, 345.
Women—
farm, contribution to family income, Nebr. 887.
rural, activities, 286.
Wood—*see also* Lumber *and* Timber.
ashes, fertilizing value, Fla. 484.

od—Continued.
gas tractors, fuel cost, 880.
paint service on, evaluation, 76.
preservatives for structural timber, efficiency, comparison, 779.
preservatives, penetration and absorption, effect of blue stain, 779.
pulp, *see* Pulpwood.
strength, effect of extractives, 779.
treated with zinc chloride and diammonium phosphate, fire resistance, 780.
utilization and lumber production in southeastern Minnesota, Minn. 42.
Woodchuck, male genital apparatus, 217.
Woodlot conditions, 1930 and 1912, Mich. 742.
Woodlots, farm, lumber production and use, Minn. 42.
Woods of Alaska, distribution and properties, U.S.D.A. 42.
Woody plants, hemicellulose in, 25.
Wool—
fiber, effect of plane of nutrition, 254.
marketing, 684.
marketing in range country, 254.
Merino and crossbred, production and price, 80.
of Merino sheep, variations in diameter and crimp, 62.
production, relation to size of ewes, Mont. 554.
quality, factors effecting, 254.
Rambouillet, show-ring studies, 254.
research work in England, 482.
review, annual, 366.
shrinkage studies, 254; Wyo. 195.
studies, Calif. 795.
Woolly aphid, *see* Aphids, woolly.
Wye College, work at, 662.
Wyoming Station, notes, 300.
Wyoming Station, report, 198.
Wyoming University notes, 300.
[illegible], revision of genus, [illegible]
Xanthophyll, identity and naming, 216.
X-ray—
experiments with Drosophila, 425.
mutations in wheat, 325.
X-rays—
application in actinomycosis and other diseases, 567.
effect on *Nicotiana tabacum*, 625.
Yacca, eradication, 533.
Yams—
intercropping cotton with, 528.
watery disease of, 345.
Yautia, yellow, vitamin B complex in, 397.
Yeast—
glutathione behavior in, 310.
in diet, effect on human milk, 398.
irradiated, feeding to cows, effect on milk, 372.
pathogenic for man and animals, 872.
samples, vitamin B and G in, 295.
Yellow fever mosquitoes dispatched from Sumatra to Amsterdam, transmission of dengue by, 550.
Yellow scale in California, imported parasite for, 549.
Yucca tribe, discussion, Tex. 817.
Zabrotes subfasciatus, morphology and biology, 551.
Zamia palm seeds, poisoning of sheep by, 571.
Zeusera pyrina, *see* Leopard moth.
Zinc—
chloride, effect on fire resistance of wood, 780.
chloride treatment for fire blight, Tenn. 150.
solubility in milk, Wis. 469.
sulfate for weed control, Ind. 141.
Zoology—
economic, textbook, 242.
in Eberswalde—100 years in retrospect, 852.
Zygorhynchus in soil flora, 320.
Zyklon fumigation against [illegible]